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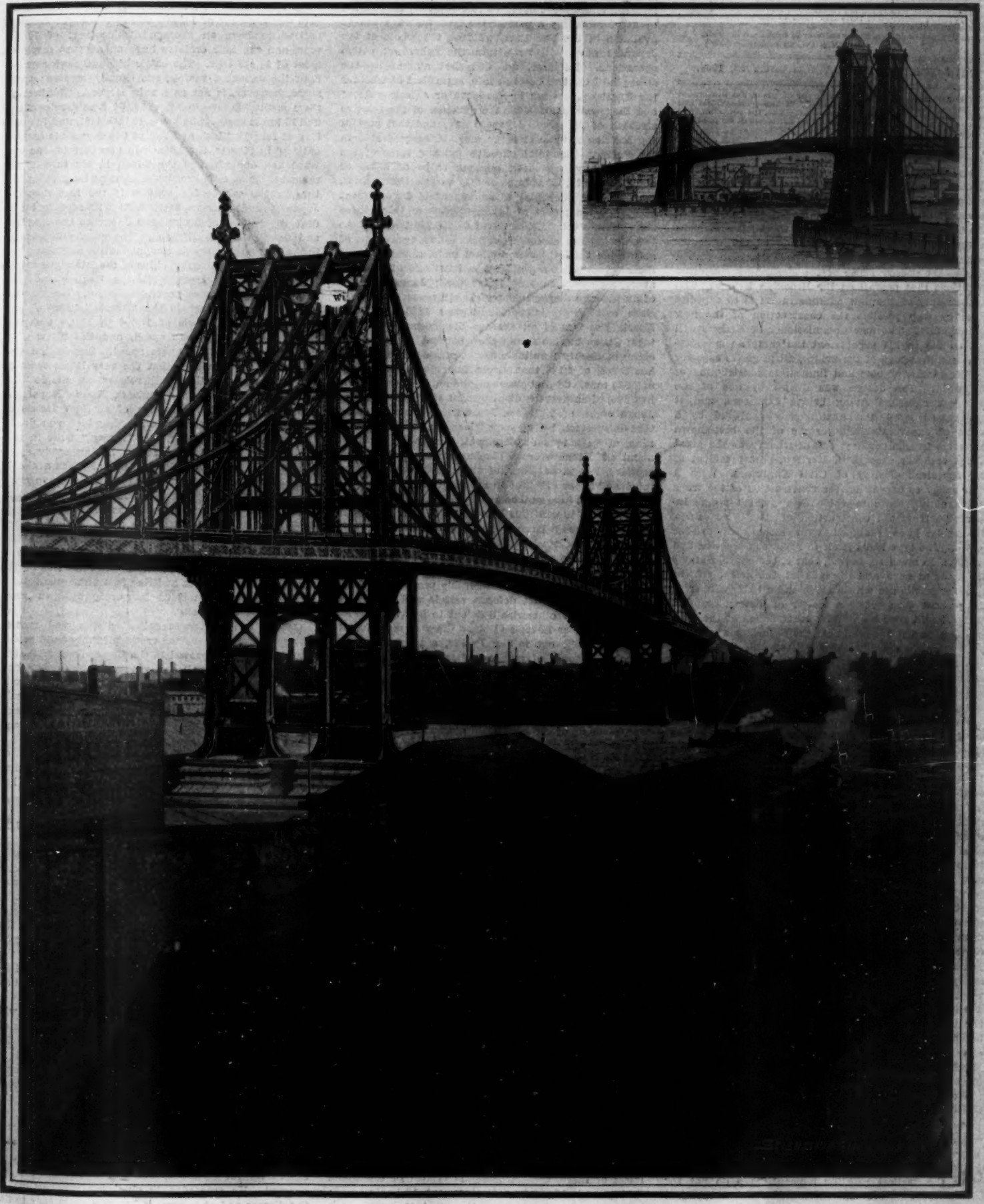

The first design, with wire cables.

Total length, 10,000 feet; length between anchorages, 2,920 feet; main span, 1,470 feet; height of towers, 400 feet; width of platform, 122 feet. Capacity of bridge: eight railroad tracks; a 25½-foot roadway; and two 12-foot foot-walks.

THE ACCEPTED DESIGN FOR THE MANHATTAN BRIDGE ACROSS THE EAST RIVER, NEW YORK, AS IT WILL APPEAR WHEN COMPLETED.—[See page 69.]

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NEW YORK, SATURDAY, JANUARY 23, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

TAMMANY AND THE NEW BRIDGE.

May it not truly be said that the biggest problem affecting the welfare of the citizens of New York that confronts the new Tammany administration is the provision of improved transit facilities? May it not also be said with equal truth that the biggest element in this problem is the construction of the urgently needed Manhattan Bridge, which was designed with a view to the speedy relief of the shockingly congested conditions that prevail on the Brooklyn Bridge? The obvious duty of the new administration is to expedite in every way possible the construction of the new thoroughfare. The new Commissioner of Bridges will find on file in his department the complete specifications and drawings of the bridge, all in good shape for the acceptance of bids and immediate construction of the work. The design was drawn by one of the most distinguished living bridge engineers, and it was passed upon and unanimously approved by a board of experts including some of the best-known engineers in this country, one of whom was the great bridge engineer, George S. Morison, past president of the American Society of Civil Engineers. With a view solely to expediting the construction of the work and avoiding the intolerable delay which seems inseparable from the construction of steel wire cables, the bridge was designed with nickel-steel eye-bar cables. The type lends itself to rapid construction and erection, so much so, indeed, that if the appropriations are made at once, and the bids let, the bridge will be open for public use within three and a half years from the present date. It is a matter of history that the bridge would have been under construction at the present time, had it not been that the necessary appropriations were withheld by the Board of Aldermen on the ground of certain technical objections raised by the engineers who were responsible for the wire cable design, which the late Bridge Commissioner condemned at the time of his taking office.

The first act of the new Bridge Commissioner was to appoint as chief engineer one of the most active opponents of the new design, and the question which is now uppermost in the minds of the citizens of New York, particularly those who live on the Brooklyn side of the river, is whether the new administration has the true interests of the city sufficiently at heart to go right ahead with the present plan, and so avoid the three or four years' delay that would result if this plan were thrown down at the twelfth hour, and the tedious and necessarily lengthy task of getting up a new set of plans undertaken. We speak of three or four years' delay advisedly. To get out the strain sheets and the enormous number of detail working plans necessary for a structure of this magnitude; to draw up specifications; to solicit bids and to close the contracts, would consume the greater part of two years' time. Then the time consumed in the necessarily slow work of stringing the cables, wire by wire, would increase the time of construction of a wire-cable bridge by at least twelve months over the three and a half years required in building the accepted design. This estimate is based, very properly, upon the record of the construction of the Williamsburg Bridge, the delay upon which was notorious.

We have no wish, however, to go at present into the question of wire cables as against eye-bar cables. We do not believe that the average New York citizen cares a snap of the finger about the relative merits of the two systems, but we do know that he is tremendously interested in getting this new bridge and getting it at the earliest possible moment. We do not for one moment believe that the most strenuous opponent of the eye-bar type considers that the present design would fail to do the work demanded of it for a thousand years to come.

The new administration has here an admirable opportunity to rise superior to mere political considerations in its desire to meet a great public necessity; while its chief engineer, by subordinating his personal preferences to the same urgent need of the public, has an opportunity to show that he can live up to the best traditions of his profession.

THE NAVIES OF RUSSIA AND JAPAN COMPARED.

The strained diplomatic relations between Russia and Japan, and the fact that in the event of a conflict the issue would be determined more than anything else by the command of the sea, render a comparison of the effective naval strength of the two nations a matter of no little interest. In such a comparison the important fact must never be lost sight of, that in the event of war, only a part of the Russian navy can be available in the Far East, whereas the whole of the Japanese navy will be within the sphere of active operations. However, we will first summarize the strength of the two fleets *in toto*, regardless of whether the Russian ships are in European or Asiatic waters; and then we will consider the question of the relative strength of the whole Japanese navy and that part of the Russian navy that is, or may be, concentrated in the Pacific. The total effective fighting force of the Russian navy, excluding obsolete ships or ships of doubtful utility, is made up of fifty vessels (battleships, cruisers, and gunboats) of an aggregate displacement of 358,670 tons; that of Japan consists of thirty-three ships, with a total displacement of 208,240 tons. These two navies are composed of the following classes of ships: Of battleships of the first class, that is, vessels launched within the past decade, Russia has ten, of an average displacement of 12,160 tons; Japan has six, of an average displacement of 14,115 tons. Of second-class battleships, launched between 1886 and 1896, Russia has ten, of an average displacement of 9,545 tons; Japan has no second-class battleships. Of third-class battleships, suitable for coast defense, Russia has three, of 4,126 tons displacement, and Japan one, of 7,220 tons. Of first-class or armored cruisers, Russia has five, of an average displacement of 10,260 tons, and Japan eight, of 9,210 tons. Of second-class cruisers, that is, protected cruisers of larger size, Russia has nine, of 6,425 tons displacement, and Japan eight, of about 4,500 tons average displacement. Of third-class cruisers, Russia has four, of about 3,500 tons displacement, and Japan eight, of an average of 2 870 tons. Lastly, Russia has nine gunboats of 500 tons, and Japan two, of 875 tons. It will thus be seen that in point of numbers Russia has a large preponderance in vessels available for immediate hostilities. Indeed, she may fairly be considered to rank as the third naval power, coming next to France, with Germany a close rival.

On the other hand, a considerable proportion of her fleet consists of coast defense vessels and ships that are too slow or otherwise deficient to be available for duty in the Far East; and since the war must inevitably be fought out in the Pacific, a forecast of the probable fortunes of war should take account only of that portion of the navy that can be concentrated near the seat of war. Applying this test, the Russian fleet is cut down to thirty-one battleships and cruisers, of an aggregate displacement of a little over 200,000 tons, made up of eight battleships, of about 12,000 tons; four armored cruisers, of about 11,400 tons; six second-class protected cruisers, of 6,500 tons; five third-class cruisers, protected and unprotected, of from 1,200 to 3,000 tons, and seven gunboats, of about 1,200 tons average displacement. To these figures may be added about a score of torpedo-boat destroyers on both the Russian and Japanese side, the Japanese boats being of about 300 tons, and the Russian of about 340 tons displacement. It will now be seen that in point of total number of ships and total displacement, the balance is somewhat in favor of Japan. Mere aggregate figures, however, do not tell the true story of relative strength, and this must be determined, in the present case, by an examination of the character of the individual ships themselves.

Other things being equal, the outcome of any naval war will be determined by the relative strength of what might be called the first line of battle, that is, vessels of the battleship and armored cruiser type that carry sufficient protection to enable them to lie in the first line of defense and attack, and endure the give and take of a great fleet action. Now it is just here that Japan is particularly strong. She has a homogeneous fleet of six battleships and eight armored cruisers that are built upon the same plans, have the same speed and maneuvering ability, and in the battleship division have the great advantage of large size of individual units. All of these vessels have been completed within the last five or six years, and they have an average displacement of over 14,000 tons. The latest of these, the "Mikasa," is typical of the whole fleet. She is 15,200 tons displacement, 18 knots speed; is armed with a 9-inch continuous belt, with 6-inch armor protecting the central battery, and she carries four 12-inch, fourteen 6-inch, twenty 3-inch, and a dozen smaller guns, all of the latest Armstrong pattern. Six of the eight armored cruisers are practically identical vessels, of about 9,700 tons displacement, and from 20 to 22½ knots speed. The other two are the fine 7,700-ton vessels illustrated on another page in this issue. They have continuous 7-inch Krupp steel belts, 5 to 6 inches protection on the casemates and turrets, and are armed with four 8-inch, twelve or fourteen 6-inch, and a dozen smaller guns. They carry four submerged torpedo tubes, with one above-water tube. It should be mentioned that the battleships also carry each four submerged torpedo boats. Now, these fourteen fast, well-protected and powerfully armed ships, with an aggregate displacement of 158 000 tons, will be matched against twelve battleships and cruisers in the Russian fleet, of an aggregate displacement of 142,000 tons. The eight Russian battleships have an average displacement of 10,750 tons, and the four cruisers have an average displacement of 11,400 tons. The battleships although smaller than the Japanese vessels, are equally modern; their speed, however, is not as a rule so good. The best of them is the "Cesarevitch," of 13,000 tons displacement and 18 knots speed. She has a 10-inch belt, and the battery of four 12.4 inch and twelve 6-inch guns is carried entirely in turrets, the 12-inch in two turrets, one forward and one aft, and the 6-inch in six turrets, arranged three on each broadside. A most interesting feature in the event of a conflict is the fact that the Japanese and Russian battleships will represent two different schools of design, the Japanese the English, and the Russian the French. The chief difference is in the method of carrying the guns of the secondary battery, which in the Russian ships of the later type is carried in pairs in turrets, while the English guns fire from casemates or open central batteries. The Russian armored cruisers include the "Rossia," "Ruric," and "Gromoboi," big vessels of 11,000 to 12,000 tons displacement and 20 knots speed, and the "Bayan," a 7,800-ton vessel of 21 knots speed. Should the war take place, it is evident that the very latest types of battleship construction will receive an ample test. In the class of protected cruisers, Russia is particularly strong in the possession of six fine vessels of 6,500 tons displacement, and speeds which run up, in the case of one of them, the "Variag," built in this country, to 24 knots, the others having easily made the contract speed of 22 knots. She also has available two third-class vessels of 3,000 tons, which have made the remarkable speed of 25 knots an hour. Against these Japan has four second-class cruisers, of about 4,500 tons and 22 to 23 knots speed, and the three curious vessels of the "Hashidate" class, of 4,300 tons, which did good work in the Chinese war. They are of 17 knots speed, and carry, strange to relate, one great 12½-inch Canet gun, in addition to a numerous battery of 4.7-inch guns. In third-class cruisers Japan has a considerable superiority.

On the point of personnel, discipline, and general efficiency of the officers and crews, all that can be said is that the Japanese proved in the Chinese war that they possess all the requisites of bravery, dash, daring, and intelligence; of the Russian personnel, nothing more is known than can be gathered from the comments of qualified observers; but the discipline is said to be excellent, and the officers are known to be a highly-educated and intelligent class of men, who are believed to have a thorough mastery of their profession. Japan will, of course, have the great advantage of fighting in home waters and within comparatively easy reach of her dockyards.

DISCOVERY OF DR. DANYSZ, OF PASTEUR INSTITUTE, FOR EXTERMINATING RATS.

The great precautions which were taken not long ago at Marseilles in order to prevent cases of pest being introduced into that port has brought up the question of contagion by rats, seeing that the rats which are carried on the vessels from the eastern countries are the principal agents in the propagation of the pest. The French government is looking for a good method of exterminating the rats so as to decrease the danger of such epidemics. Dr. Danysz, of the Pasteur Institute, has lately been studying the question of the destruction of parasites and claims to have discovered a novel method for destroying rats which will be quite successful. Different methods have been tried before this, among others the Clayton apparatus invented in England, which destroys the rats by asphyxiating them with carbonic acid gas. But Dr. Danysz has found a means of getting rid of the rats without the risk of killing any other animals, and thus the method may be applied especially in the country, on farms and in different establishments where the other animals are to be free from harm. In the course of his researches, Dr. Danysz found that the rats can contract a special disease to which other animals are not exposed. He succeeded in obtaining the bacillus of the disease and at present it becomes quite easy to destroy these animals. It is necessary only to soak bread or grain in a bouillon of the microbe culture and allow the rats to eat it, when they contract the

malady and usually die within the space of five to twelve days. A number of experiments have already been made with the new method, especially in the sewers of Paris, which are full of rats, and very good results have been obtained. It was proved during the experiments that the young rats are the most sensitive to the action of the microbe. At present the new rat-exterminating culture is coming into practical use at Paris and especially at the Bourse de Commerce where it is used to protect the deposits of grain. Dr. Chantemesse, who is now at Marseilles, has sent to Paris for a large quantity of the culture and he intends to use it for destroying the rats on shipboard.

THE THEATRE FIRE AND ITS PREVENTION IN GERMANY.*

BY CARL LAUTENSCHLAEGER, TECHNICAL STAGE DIRECTOR OF THE METROPOLITAN OPERA HOUSE.

Despite the rapid advances made in almost all the arts since the introduction of the steam engine and its attendant improvements in the mechanical industries, stage-building has progressed more slowly than almost any other branch of architectural engineering. Even in Germany, a land of model theaters, there are still to be found stages not much better in arrangement than those of the seventeenth century. Even the introduction of illuminating gas did little to improve the conditions. In countries where no very strict laws for the prevention of fire have been enacted, countries such as France, England, Russia, and the United States, we still find much of the insecurity of previous centuries. Although almost every year can show its appalling record of theater fires, the various European governments were not spurred into activity until the great fire of the Ring Theater in Vienna. Strict laws were then passed, the purpose of which was to secure better fire protection in theatres of long standing, and the utmost possible safety in structures still in course of erection. It was largely as a result of these stern measures that the first iron theatre was built in Germany, in Schwerin in the eighties, according to the plans of Carl Lautenschlaeger. To-day, the laws of Prussia provide that stages must be built entirely of incombustible material, with the exception of the stage floor.

Stage illumination has been revolutionized in late years. Gas, which is the cause of many, if not most, catastrophes, was supplanted by the safer electric light.

In a properly-designed stage, almost everything with the exception of scenery and the stage floor can be made of iron or other incombustible material. The stage floor itself can be impregnated with suitable chemicals. The only combustible parts in reality are the properties and the scenes, which, since they must of necessity be painted upon canvas mounted on wooden frames, are naturally highly inflammable. It may be statistically shown that even if all the scenery and properties of a large production were to burn, still the ironwork could hardly be heated to a dangerous point. Painted canvas produces more smoke than flame. The heat generated rises to the upper part of the stage. Moreover, constant supplies of fresh, cool air are always received from below. Audiences have more to fear from smoke, consisting largely of poisonous carbon monoxide gas, than from flame; for the gas spreads outward with great rapidity from the stage to the audience. In order to confine the smoke to the stage, iron curtains are used in Germany, which also serve the purpose of shutting off the flames long enough to permit the entire burning of the scenery, which is, after all, the chief source of danger. If iron curtains are used, it is evident that the entire stage scenery may be completely burnt without in the least subjecting the public to peril.

Absolute safety from fire can be obtained only by using incombustible material throughout the theatre. So far as the actual building of the auditorium and stage is concerned, this ideal can be obtained. Girders, pillars, floors, staircases, roof trusses, can all be made of iron. In the auditorium itself, the only combustible material is to be found in the chairs, cloakrooms, and box offices.

Since combustible scenery and properties must of necessity be used, measures have been taken in Germany for the purpose of checking and extinguishing a fire from the minute of its discovery. Every German theatre has its staff of firemen, who are either drilled employés of the theatre or members of the city fire department. Much store is set in Germany upon the employment of many trained firemen. At least eight to ten men are to be found in every theatre. For very large productions, the number is usually twelve. Five firemen must sleep in the theatre each night. Stages which have wooden floors are watched night and day. Stages which are built entirely of iron, and therefore open to little danger, are watched only during the day and during a performance. It is evident, therefore, that as a matter of economy alone, the iron stage is to be strongly advocated. The firemen have at their command an admirable water-distributing system. On every German stage there are at least four hydrants, one in each corner of the stage, four on the lower galleries, and four on the gridiron. If there be a rear stage, or Hinterbuehne, as it is called in Germany, it is provided with one or two hydrants.

An admirable arrangement for the extinguishment of a fire immediately after its discovery, an arrangement now used throughout Germany, is the sprinkling apparatus invented by Hofrath Stehle, and first used in the Royal Court Theater of Munich in 1874. By means of the apparatus it is possible to extinguish a fire not only at any particular part of the stage, but also completely to drench those parts which have not yet been ignited, thereby preventing a spreading of the flames. A typical example of a Stehle installation is to be found in the Prinz Regent Theater of Munich. At the level of the gridiron, pipes are extended across the stage, each pipe perforated with many holes. Water-tanks on the roof communicate with these pipes, through four mains controlled by valves. To the hand-wheel of each valve a wire rope is fastened, which is carried to the side walls of the stage, and thence descends to a point within convenient reach. These ropes are so connected with a single operating lever that either one valve, two valves, three valves, or all four valves can be opened, so that either a portion of the stage or the entire stage can be drenched with water. Only firemen are permitted to operate these valves. Had a similar device been in use in the Iroquois Theatre, the terrible disaster which occurred would have been avoided. How serviceable this apparatus of Stehle actually is has more than once been proven. On one occasion, during a performance of "Das Rheingold," in which guncotton is used to produce lightning flashes, some of the gauze clouds were ignited. A vigilant fireman pulled the rope lever. The sprinkling apparatus was immediately set in operation, and the scenery and stage so thoroughly soaked with water that the flames were almost at once extinguished. The audience never for a moment suspected the danger in which it had been, and mistook the downpour of water for a bit of modern stage realism. Only after the accident had been reported in the newspapers a few days later, did any one know of the danger that had been avoided.

This sprinkling apparatus is annually inspected at each theatre with a rigorousness that leaves nothing to be desired. At such times, a large trough is placed on the stripped stage. At a signal from the fire inspector, usually a whistle, the water is turned on. A few days later the results of the official test are published in the newspapers, with the result that the public is assured of the safety of its theaters.

The main reliance for safety in Germany, as elsewhere, has always been the curtain. The enormous pressure of the gases developed renders any curtain having as a basis a textile fabric of questionable utility. The stoutest asbestos curtain cannot long withstand this pressure. It would be torn into shreds. In Prussia the law requires that iron curtains be used. They are so arranged that they can be lowered from the director's box or from any other convenient point; but even an iron curtain cannot long withstand the pressure of a stage fire. At best it would last but a quarter of an hour. Still, in that time the most leisurely audience would find time to escape.

In Prussia the iron curtain must withstand a pressure of 90 kilogrammes per square meter. This apparently unnecessary requirement is of importance if the curtain be used on an old stage built entirely of wood. The difference in weight between the cold, heavy air of the auditorium and the hot air of the flaming stage is so great that the pressure upon the iron curtain is considerable. In Buda-Pesth it has happened that, despite constant sprinkling, an iron curtain bulged out and finally collapsed. The elevating apparatus of the iron curtain should always be of such a nature that if it be thrown out of gear, it is always possible for the curtain to descend by its own weight. The curtain-raising apparatus should be installed upon the stage floor. It should also be possible to drop the curtain from the adjacent corridor, since the flame and smoke of the stage may render it impossible to operate the curtain from the stage.

Owing to its peculiar construction, a stage cannot be made absolutely fireproof. It is essential that when a fire does occur, the gases be allowed to float upward in a strong draft. At the Prinz Regent Theater, previously referred to, this end is attained by huge ventilators, located at the very top of the stage, over the gridiron. They are controlled by manila ropes operated by the firemen from the stage floor. Even if they should not be lowered by the firemen, they would drop of their own accord upon the burning of the ropes.

Although there may be no actual danger of fire in a properly-constructed theatre, still an audience may become panic-stricken at the mere smell of smoke and the sight of flames. In such cases there is always a mad rush for the exits. It is therefore of prime importance that the auditorium be emptied with the utmost dispatch. The chief source of danger to life is found in the staircases. Winding stairs should be always avoided. Long staircases present the possibility of causing an injury to those at the lower steps by the pressure of the people above them. Very broad staircases are also objectionable, for the absence of railings in the center robs many of means of support. The most favorable type of staircase is that in which the steps are about 9½ feet wide, with 12 to 16 steps to the flight.

Since there is always an arch over the proscenium, the free space between the lower edge of the arch and the framework of the proscenium opening should be closed with a fireproof wall.

* Mr. Lautenschlaeger's suggestions deserve more than passing attention. He is a recognized authority the world over on stage design, an expert stage engineer, and ex-mechanical director of the Prinz Regent and Residenz theaters of Munich.

SCIENCE NOTES.

The fundamental features of the contact process for the manufacture of sulphuric acid were first described in an English patent granted in 1831 to Peregrine Phillips, Jr., of Bristol. The patent covered the application of platinum in a finely divided state for the oxidation of sulphur dioxide, and expressly stated how the catalytic action was to be obtained. Soon after the publication of Phillips's invention, experiments were undertaken by German chemists, but it was not until recently that the process was worked out in all its details and became a technical success.

Commendatore Boni has made further discoveries in the Forum at Rome, among them the site of the ancient temple of Janus, a small structure compared with later temples. In a gallery about twenty feet under ground he thinks he has discovered the substructure of the theatre built by Julius Cæsar. Short galleries ending in a square chamber run at right angles from the long gallery, four on the left and three on the right. All these chambers are connected by a narrow terra-cotta tube. His explanation is this: The gladiators entered these chambers and at a signal given by way of the terra cotta tube they rose up through trap doors, as if out of the earth, and appeared in the arena before the public. The tubes have been cleared and are found to work perfectly, while objects discovered in the galleries give further indications of their use.

How marked has been the advance in medicine during the last ten years, is shown by the report of the Vital Statistics Department of the Census Bureau, and how beneficial the effect of the introduction of antitoxine is shown in a most telling way, by the decrease in the death rate of fifty per cent. In croup the death rate has been reduced from 27.06 to 9.8 per 100,000. The reductions in other diseases are as follows: Typhoid fever, from 46 to 33; brain diseases, from 30 to 18; bronchitis, from 74 to 48; cholera infantum, from 79 to 47; malarial fever, from 19 to 8; whooping cough, from 15 to 12; convulsions, from 56 to 33; and scarlet fever, from 13 to 11. On the other hand, the death rate in some ailments has increased. The death rate of cancer in 1890 was 47. In 1900 it was 60. The rate for apoplexy has increased from 49 to 66; while the increase for diabetes and kidney diseases is respectively from 5 to 9 and from 59 to 83. No doubt these augmented rates are due to the conditions of life, which are not within the power of medical science to control. From the figures quoted it certainly follows that the general health of the people of our country is improving, and nothing shows this more clearly than the fact that the deaths from old age in 1890 were but 44 per 100,000, while in 1900 they were 54.

Sodium bisulphate, the residue of the manufacture of nitric acid, is a cumbrous product; it is drawn from the boilers from which the nitric acid produced by the reaction of sulphuric acid or sodium nitrate is extracted, and poured into the receivers, where it must be left to crystallize. The purpose in the manufacture of superphosphate is to put in advance into the receivers in which the sodium bisulphate is to be collected, lime phosphates in powder and in determined quantity, according to the quantity of the bisulphate to be collected. As the liquid bisulphate comes in, the mass is stirred with rakes, and the lime phosphate is immediately converted into superphosphate, the solubility of which is almost as great in water as in ammonium citrate. The superphosphate thus produced may be poured into chambers, as in the manufacture of ordinary superphosphate. In all cases, it may be drawn from the receivers without danger, the bisulphate being then converted into an inoffensive pasty mass. A few days afterward the superphosphate obtained may be pulverized by ordinary methods, and is then ready for agriculture. The sodium sulphate which is found in this superphosphate in consequence of the employment of sodium bisulphate, is not injurious in its results; on the contrary, it has been proved that certain plants absorb and assimilate the sodium in the absence of potash.

A GREAT MAMMOTH'S TOOTH.

BY W. FRANK M'CLURE.

Three miles south of Lake Erie, near Amboy, O., is a gravel pit which from time to time has proven rich in relics of the glacial period and of the mammalian age, despite the fact that relics of mammoths are not as a rule found below the fortieth parallel. This pit is in the midst of what was, a few years ago, a gravel bed of fifty-five acres, but which is now being exhausted by railroads depending upon it for ballast supplies. Prior to the upheavals of the early period, which caused the lay of the land to change and the water to recede, this gravel bed was undoubtedly a swamp near the lake banks, while the present site of such lake cities as Ashtabula and Conneaut were then the bottom of Lake Erie. Amboy is to-day 130 feet above the level of the lake.

From this gravel pit, among the relics unearthed, have been found tusks eight feet in length, also a giant tooth weighing nine pounds and three ounces, having a length of one foot and a circumference of twenty-six inches. At this depth, too, have been found numerous timbers laid side by side, much resembling a corduroy road. Geologists have visited the spot from time to time, and have found much food for reflection. The tooth heretofore mentioned, and which is shown in the accompanying photograph, is a molar of the *Elephas primigenius*, commonly known as the mammoth, the most perfect specimens of which have been found in Siberia. Ten thousand years ago these animals, now extinct, roamed over Europe in herds. The tusks found at Amboy are curved instead of being comparatively straight, which would imply that they were those of a mammoth rather than the mastodon.

No unusual discoveries whatever were made at Amboy until a depth of 35 feet was attained. At 35 feet the so-called "corduroy road" was uncovered. Immediately the theory of this being the work of prehistoric man was advanced, but was given no credence by authorities, who at once pronounced it a relic of the glacial period, and in this decision is also, undoubtedly, the solution of the finding of the teeth and tusks of mammoths.

It is reasoned that, during the glacial period, huge glaciers coming from the north brought with them portions of felled forests, and lodged them in the swamp territory where is now the gravel pit. The fact that the logs were cedar rather than the wood usually found along the banks of Lake Erie lends weight to this theory. The relics of the mammoths also undoubtedly came down with these glaciers, these great animals being inhabitants of colder climates.

Another less reasonable theory, which has been advanced from time to time in connection with the finds at Amboy, is that the glaciers, on coming from the north, felled the trees in Amboy swamp. Then a change of climate causing the glaciers to melt, the quantities of gravel which they carried were deposited, thus covering the trees to a great depth. Advocates of this theory further say that the mammoths were browsing in the swamp when the glaciers felled the trees about them. If the relics found were those of a mastodon, this would not be so improbable, for relics of mastodons have often been found south of the fortieth parallel. However, besides the difference in the tusks before mentioned, it will be noted that the big tooth is comparatively smooth, while the tooth of a mastodon is covered with projections.

TOOTH OF MAMMOTH UNEARTHED AT A DEPTH OF 35 FEET.

Weight, 9 lb. 3 oz.; length, 1 ft.; circumference, 2 ft. 2 in.

ELECTRIC SLEEPING CARS.

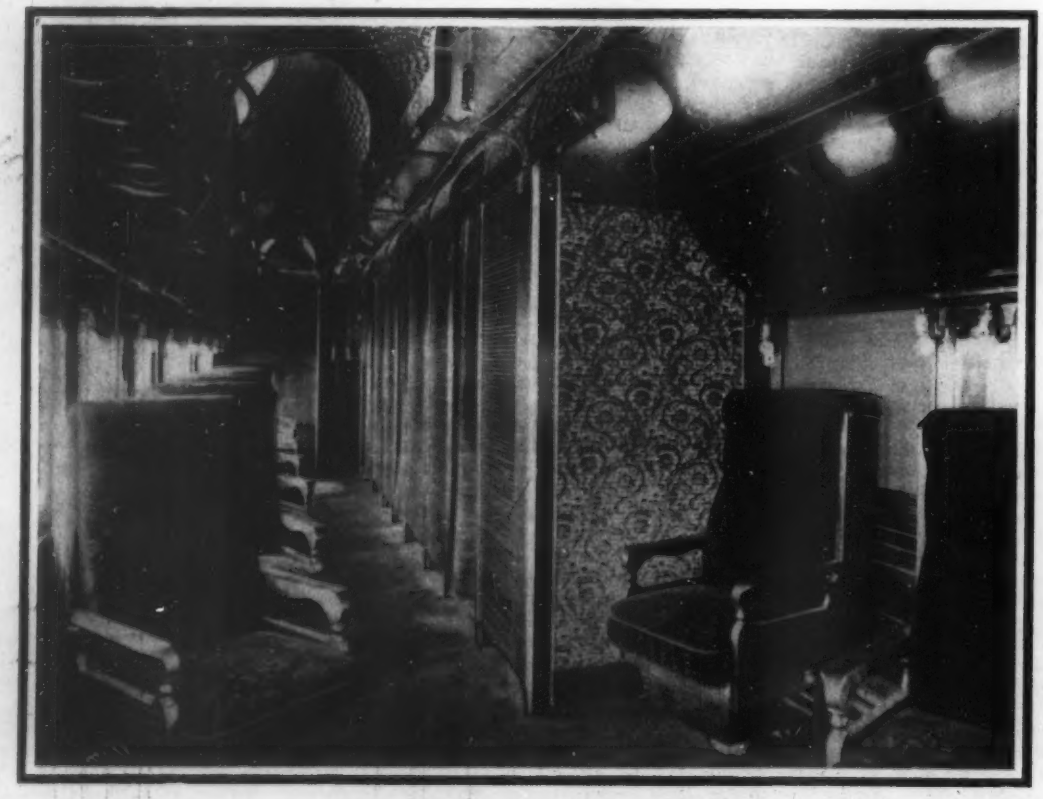
BY GEORGE J. JONES.

The electric sleepers which have been recently put into service between the cities of Indianapolis, Ind., and Columbus, Ohio, are similar to the sleeping cars of standard construction, and yet radically different. The most striking innovation is in the construction of the berth, which gives the passengers in each section at least the seclusion of a private room at home or in a hotel. Each section has an upper and lower berth of sufficient proportions to hold one person each, and the two beds are entirely surrounded by a substantial partition.

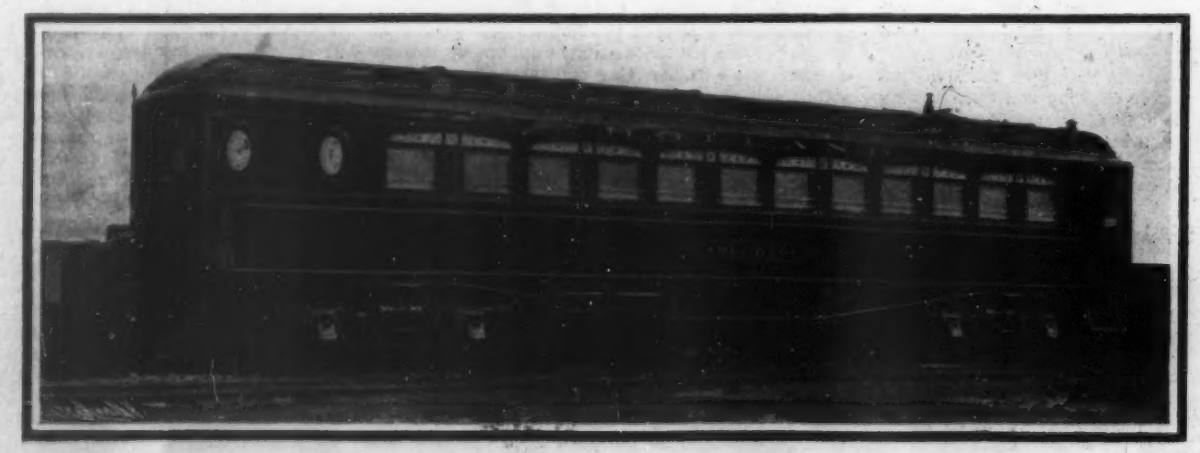
At either end of the car are smoker, wash rooms, lockers, and other comforts, conveniences, and necessities which are to be found on the standard railroad car. The main room is 34 feet 2 inches in length, and by day it has all the appearance of a chair car of the ordinary type, the seats being carried on revolving pedestals, spaced 3 feet 6 inches apart, and 16½ inches from the side of the car. It is intended that the car shall make one round trip each day between the two cities, the day trip being made as a chair car, and the return at night as a sleeper. The berth appointments are as thoroughly disposed of by day as is the case in the Pullman or Wagner car. The chairs are very comfortable, and because of the increased room, comfort and freedom enjoyed by the passengers, it is thought that the cars will be as much in demand by day as by night.

When it is desired to make up a section, a catch at the side of the chair releases the back and it is allowed to fall into a horizontal position, the two chairs forming the bed of the lower berth and lying end to end parallel with and against the side of the car. The arm next to the wall is dropped into a horizontal position and plays a part in the support of the bedding. The other arm is removed entirely and laid aside until it is wanted again when the chair is needed. The headroll of the seat is dropped forward to form a pocket for the clothing of the passenger. The upper berth is exactly the same as that of the ordinary Pullman, and carries the bed clothing for both beds. In completing the making up of the section, after the beds have been prepared, several removable posts are brought from a locker at one end of the car and placed in suitable receptacles in the floor, their tops being locked in the bottom part of an ornamental grill work which extends the entire length of the car. These posts are suitably grooved for the accommodation of a flexible wooden wall which forms the three sides of the little room. These partitions are made on the principle of the roll of the roll-top desk, but work on a spring so that when out of use they are stored between the false and real floor of the car. There is one of these disappearing walls at each end of the berth and two are required to form the partition at the side toward the aisle. This is in order to permit of the formation of an opening which answers the purpose of a door in the center of the little room. The recesses which hold these curtains or partitions are hidden by a metal plate during the day time, and this is removed by the porter when he wishes to pull up the curtains. When the section is in use, the door is shielded by a piece of drapery. When the compartment is ready for occupancy, there is a space clear of the berth, 15 inches wide by approximately 6 feet 9 inches long, which gives ample room to put on and remove clothing.

This curtain affords some ventilation, and this is further provided for by four-inch openings at the bottom of the parti-



INTERIOR VIEW SHOWING SECTIONS MADE UP.



NEW ELECTRIC SLEEPING CAR FOR SERVICE BETWEEN INDIANAPOLIS AND COLUMBUS, OHIO.

tions; thus a constant current of air can flow through the section, entering the bottom and passing out through the grill work at the top.

The exterior of the car has very much the appearance of the standard railroad coach, except that it is much shorter. It has deck lights, broad double windows and extended vestibules. The dimensions of the car are as follows: Length of car over all, 56 feet 4 inches; height from rail, 13 feet 4⅝ inches; clear head-room inside, 6 feet 5¾ inches. There are six longitudinal wood sills, 7 x 7 inches in section, in the floor made in two pieces with a half-inch steel plate sandwiched between.

The construction of the trucks is much the same as that for regular railroad service. They have four wheels each, and each axle is supplied with a 150-horsepower motor built for a speed of 60 to 70 miles an hour. The details of the construction of the electric sleeping car were worked out by M. F. Holland, and the cars built by the Harlan & Hollingsworth Company, of Wilmington, Del.

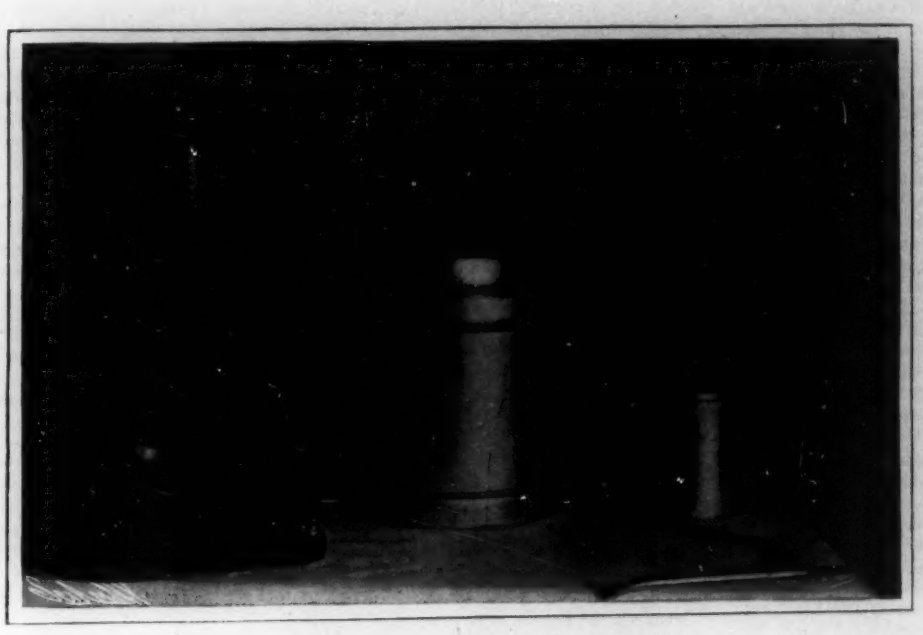
A SIMPLE LABORATORY BLOWPIPE APPARATUS.

The following article is a description of a simple and inexpensive vaporizer for laboratories without the convenience of a gas supply; its chief advantages being its even operation and the ease with which the pressure can be varied. One of the size given is suitable for almost all laboratory work.

The foot bellows is 15 inches long by 11 inches wide, and is expanded by a coiled spring within. The inlet valve is of the clapper type, and takes air from the underside. The outlet valve is of the same class, and exhausts the air into a small tin dome, from where it is conducted by tubing to the gasometer or holder.

The entire gasometer is built of galvanized iron. The outer cylinder or water tank is 12 inches high by 14 inches in diameter. The inlet pipe extends from the outside half way toward the center of the tank upon the bottom, where it is bent at a right angle and reaches perpendicularly to a level with the top of the tank. The outlet pipe is a counterpart of the inlet, with the exception that it has an upright branch outside of the tank which leads to the vaporizer, the other branch leading to the air blast of the blowpipe. The inner inverted cylinder or gasometer is 12 inches in diameter by 14 inches high. At diametrically opposite points at both top and bottom are affixed guide wheels with concave faces. The wheels upon each side, being perpendicularly in line, run upon guide rods extending along the sides from the base of the outer cylinder or tank to a height of 14 inches above it. The guide rods are made separable from the tank to facilitate removal of the gasometer. The latter must rise and fall freely without hitching, otherwise the supply of gas and air to the blowpipe will be jerky. When in use, the outer cylinder is filled with water to within an inch of the top.

The vaporizer is a galvanized iron vessel 6 inches in diameter by 10 inches high, which is half filled with gasoline when in use. The inlet pipe extends from the outside through the top to within a quarter of an inch of the bottom. The outlet pipe extends just within the dome. The inlet should be marked to prevent mistake in coupling up.



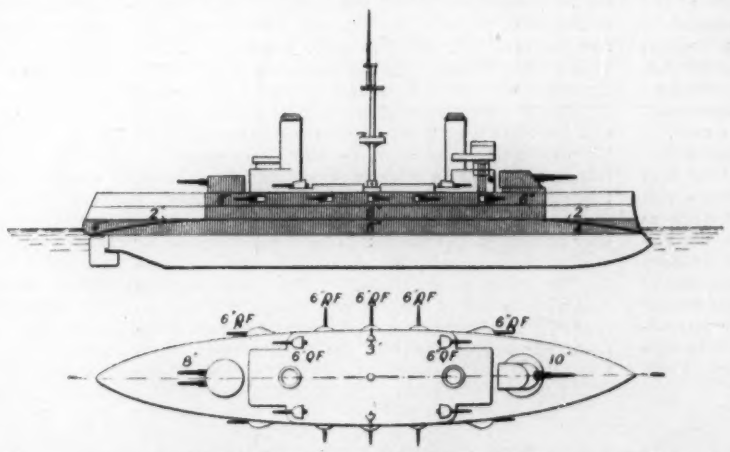
A SIMPLE LABORATORY BLOWPIPE APPARATUS.

Each downward stroke of the bellows raises the gasometer, which feeds air to the vaporizer and air blast. The quantity of air or gas is regulated in the usual way by stopcocks at the blowpipe. The machine gives a steady, even pressure, which can be increased at will by placing weights upon the gasometer. It is serviceable with any blowpipe, and is useful for other purposes where a supply of gas is necessary.

NEW JAPANESE ARMORED CRUISERS "KASAGA" AND "NIASIN."

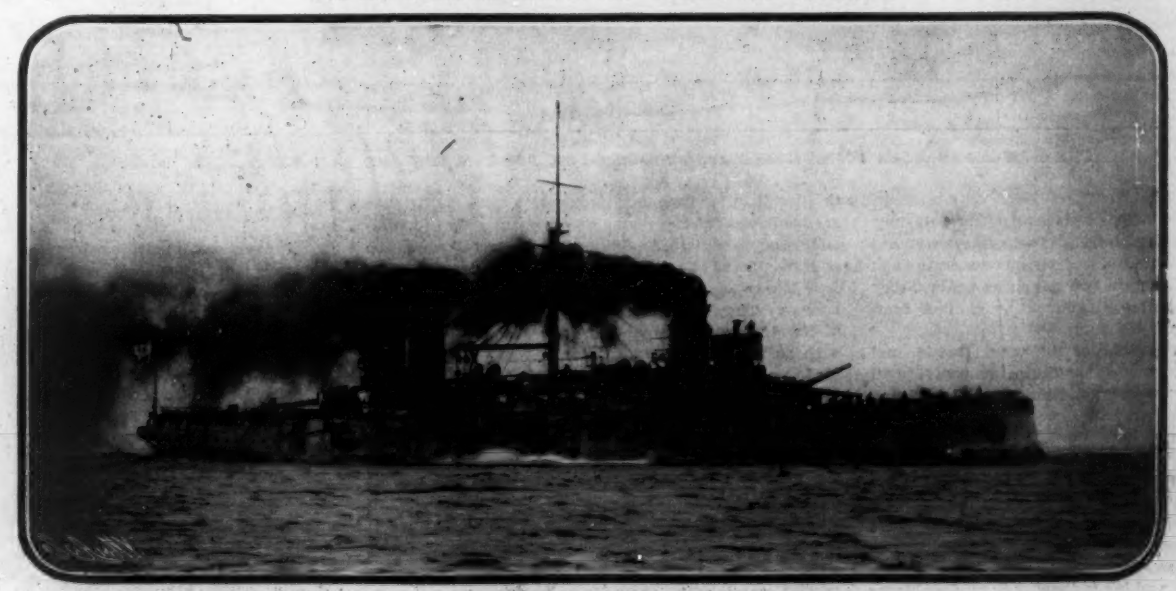
The recent agreement of Chile and Argentina to reduce their armaments has resulted in a very important accession to two of the leading navies of the world, those of Great Britain and Japan. At the time when the more pacific relations were established between the two South American republics, there were building for Chile two very fine warships of 11,800 tons displacement, the "Constitucion" at the Armstrongs', and the "Libertad" at the Vickers' yard, while two equally efficient and up-to-date armored cruisers of 7,700 tons displacement were under construction for Argentina at Ansaldo, Italy. When it became known that these four formidable vessels were on the market, the agents of the Russian government commenced negotiations for their purchase. These negotiations progressed so favorably that it seemed pretty certain that Russia was about to make an addition to its navy of four first-class fighting ships. This would have been more than sufficient to turn the balance of naval power in the Far East completely in her favor in the struggle that now looks to be so imminent between her and Japan. At the eleventh hour, however, agents representing the British and Japanese governments made such extremely liberal offers for the four vessels that the deal was closed, and the two battleships hoisted the British flag, and the two cruisers the flag of her possible ally, Japan.

The "Rivadavia" and "Moreno," as the two cruisers were known, have been rechristened the "Niasin" and "Kasaga," have hoisted the Japanese flag, and, with full crews aboard, are now making all speed by way of the Suez Canal for far eastern waters. The new cruisers are of the same general type as that most efficient vessel, the "Cristobal Colon," whose wreck still lies on the southern coast of Cuba, where she was headed off and driven ashore by the guns of Admiral Schley's flagship, the "Brooklyn," and the battleship "Oregon." The "Kasaga" and "Niasin" are identical in every respect but one; the one difference being that the main battery of the "Niasin" consists of one 10-inch gun and two 8-inch guns, while that of the "Kasaga" consists of four 8-inch guns. The accompanying very striking photograph of the "Kasaga" was taken when that vessel was on her trial trip, in which she averaged a speed of 20.2 knots, over a course 12 miles in length. While the speed is not a high one as speeds go in armored cruisers to-day, it is very creditable if we bear in mind the heavy armament and excellent protection that are secured on the limited displacement of 7,700 tons. The "Moreno" is 357 feet in length, 61½ feet in breadth, and draws 23 feet of water. She is driven by two sets of triple-expan-



"Kasaga" has two 8 in. in place of one 10 in. gun forward.

GUN AND ARMOR DIAGRAM OF THE "KASAGA" AND "NIASIN."



Displacement, 7,700 tons. **Speed,** 20.2 knots. **Bunker capacity,** 1,100 tons. **Armor:** Side, 6 in. to 4½ in.; turrets, 5½ in.; battery protection, 6 in.; two armored decks, 1½ in. and ⅝ in. **Armament:** Four 8 in.; fourteen 6 in.; ten 3 in.; four small guns. **Torpedo tubes:** Four above water and behind 6 in. armor. **Complement,** 595.

NEW JAPANESE ARMORED CRUISER "KASAGA"; ALSO SISTER SHIP "NIASIN."

sion, three-cylinder engines, and was designed to make 20 knots with 13,500 horse power. In her boiler rooms are four single-ended and four double-ended boilers. She carries a normal supply of 650 and a maximum supply of 1,100 tons of coal, and her full complement of officers and crew is 525. Her protection consists of a complete belt of armor from stem to stern, which is 6 inches thick amidships and tapers to 4½ inches at the ends. With this is associated a complete deck 1½ inches in thickness, which slopes at the sides to meet the bottom edge of the side armor. The space between the slopes and the side armor is utilized for coal bunkers, and back of the sloping deck are other coal bunkers. Further protection is afforded by the main deck, which is of steel ⅝ of an inch in thickness. The 6-inch side armor is carried up amidships through the height of two decks, extending from below the water line to the upper or main deck, through a height of over 20 feet. This armor is carried athwartships around the bases of the barbettes, the bulkheads thus formed being of 4½-inch armor. The armor, by the way, is of what is known as the Terni type, which has shown qualities which compare favorably with the best Krupp armor. The main battery consists of four 45-caliber, 8-inch, rapid-fire guns, mounted in two turrets protected by 5½-inch armor, one forward and one aft, on the longitudinal axis of the ship. The intermediate battery consists of fourteen 6-inch rapid-fire guns, ten of which are located on the gun deck within the 6-inch armored citadel, while the other four are mounted behind heavy shields on the main deck, two on either broadside. The four 6-inch guns at the corners of the gun-deck battery and the four guns above mentioned are able to fire dead ahead or dead astern, the concentration of fire ahead or astern being, therefore, two 8-inch and four 6-inch guns. There are also ten 3-inch rapid-firers, four of them being mounted on the gun deck, two forward and two aft, and firing through ports, and six of them being mounted in broadside on the upper or main deck, three on each side between the pairs of 6-inch guns. The vessel also carries four above-water torpedo tubes, which are mounted on the berth deck and fire through discharges in the 6-inch side armor of the vessel, the protection for these tubes being, therefore, very satisfactory. There are two conning towers, one forward and one aft, the forward tower being protected by 4¾ inches of Terni armor. The vessels have two smokestacks and a single central military mast, in the tops of which are mounted two Maxim guns.

Altogether, for their displacement, we consider that these are as effective fighting units as have ever been designed. Of course, they do not have the advantage that comes from great size and high speed, such as characterize the 24-knot, 14,000-ton British cruisers of the "Drake" type, or the 22-knot, 14,500-ton armored cruisers of the "Tennessee" class now building for our own navy. At the same time, because of their shorter length, these vessels will prove very handy in maneuvering, and with their powerful batteries will be able to stand up against ships of considerably greater size than themselves. The Russians have only one armored cruiser of the same displacement, the "Bayan," that can compare with them. Although the latter has two knots more speed and is slightly heavier in the belt protection, she carries only two 8-inch as against four 8-inch rapid-firers, and eight 6-inch as against fourteen in the "Kasaga."

In the event of hostilities between Russia and Japan, there is no question that these two vessels will prove to be an invaluable addition to the fighting strength of the Japanese navy.

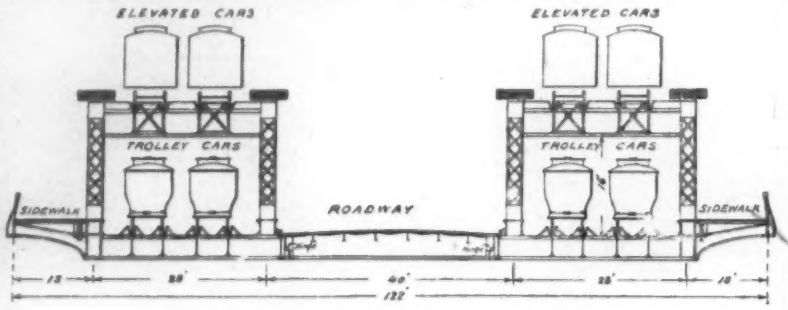
An apparatus in use in Germany for the purification of milk by osonization is so constructed that the milk contained in a vessel flows thence in a thin stream into another vessel, placed below. An electric circuit is so arranged that sparking is caused through the stream or near it. The ozone which is thereby engendered from the oxygen of the air is said to be sufficient to kill all micro-organisms contained in the milk.

THE MANHATTAN BRIDGE ACROSS THE EAST RIVER.

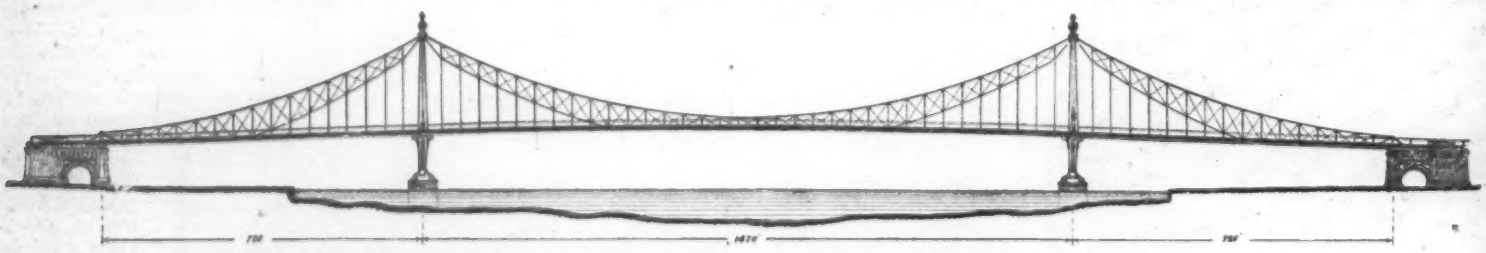
The foundations and piers for the new Manhattan Bridge across the East River are nearly completed, and the plans and specifications for the steel superstructure are in shape ready for the letting of the contracts. This bridge will run from near the intersection of the Bowery and Canal Street in New York to Willoughby Street between Prince and Gold Streets in Brooklyn. It will be considerably the longest of the big bridges across the East River, measuring about 10,000 feet between terminals. The original design of the structure, a small sketch of which is shown on the front page of this issue, called for a steel-wire cable, suspension bridge, carried on four towers of a general rectangular cross section and consisting of heavily-trussed columns of a type resembling, in a general way, those of the recently opened Williamsburg Bridge. When the late Commissioner assumed control, it was decided to take advantage of the backwardness of the foundations for the bridge, and revise the plans and build a structure of greater capacity and more pleasing appearance. The work of preparing the plans was put in hand at once, and, as we have said, matters are now in shape for the immediate commencement of the construction. The floor of the bridge will be 122 feet wide over all, and therefore a little wider than the floor of the Williamsburg Bridge. The center span will measure 1,470 feet from center to center of towers, or 130 feet less than the center span of the Williamsburg Bridge, and each of the side spans will be 725 feet in length from center of towers to anchorages. The two steel towers will rise to a height of 400 feet above mean high water. With a view to expediting the construction and avoiding the great delays incidental to the laborious and necessarily slow process of stringing steel wire cables, and also with a view to bringing the structure up to the most modern and approved methods of design for long-span suspension bridges, it was decided to build the cables of nickel-steel eye-bars; and instead of constructing separate stiffening trusses as part of the floor system, it was decided to build these trusses as part of the suspension chains, utilizing the chains as the top chords of the trusses. Apart from the great ease and rapidity of erection, and the graceful appearance of the finished structure, there was a constructive advantage in the fact that the deepest part of the trusses occurs at the quarter lengths of the span, where the bending stresses are greatest, while the trusses are shallowest at the center of the span, where theoretically they ought to be shallow, in order to reduce the stresses due to changes of temperature. There will be four lines of eye-bar chains with their stiffening trusses. They will have fixed connections at the top of the towers, the cradles on rollers being dispensed with as an obsolete arrangement. The chains will be made up of 18-inch nickel-steel eye-bars. At the point of connection to the towers each chain will consist of four bars 18 inches in depth by 1⅝ inches in thickness and sixteen bars 18 inches in depth by 1 11-16 inches in thickness. The trusses will be built with panels 45 feet in length, and at each panel point there will be pin-connected suspension members, which will support the roadway.

The main floor of the bridge will be carried upon plate-girder floor beams, one at each panel point, which will be supported at the ends and at two intermediate points from the suspension chains. The floor beams will have short cantilevers projecting beyond the outside points of support, which will carry the footways, each of which has about 12 feet of clear width. These footways being on the outside of the trusses will afford to pedestrians a clear view of the river. The space between each pair of trusses will be devoted to the elevated and street railroads. The elevated cars will be carried upon an upper deck which, at the center of the bridge, will be about on a level with the chain cables, while the street cars will run upon the floor of the bridge. The center of the suspended structure will be devoted to a 35½-foot carriage and vehicle roadway, which will provide sufficient space for four three-horse teams to drive abreast if need be.

The towers of the bridge are of novel construction, and are of extremely light and pleasing appearance. Each consists of four very massive columns standing in one transverse plane the columns being located in the same vertical planes as the chain cables. Instead of the base of the towers being carried out to a broad base, as in the lately finished Williamsburg Bridge, the columns viewed from the side elevation taper from their greatest width of 22 feet at the platform down to a width of 14 feet, where they rest upon a large hollow forged steel pin, two feet in diameter. The pin itself rests in a massive ribbed cast-steel footing. The object of this construction is to insure that the load of the tower will be distributed evenly over the top of the masonry piers. By causing the load to pass through a central pin, from whence it is distributed through a broad steel pedestal, the possibility of uneven pressure on the masonry is entirely eliminated, and every part of the pier will receive its proper share of the load. Theoretically, the tower is free to rock on this two-foot pin, in the direction of the axis of the bridge, but actually the movement of a few inches one way or other at the top of the tower, due to changes in form of the chain resulting from live load and temperature, will be taken care of by the elasticity of the tower itself. It must not be supposed that the presence of the hinged joint threatens the stability of the tower; for it must be remembered that the chain cables are rigidly attached to the top of the tower, and consequently hold it permanently in its proper vertical position. The use of a massive saddle on roller bearings at the top of suspension bridge towers had come to be regarded by leading bridge engineers as an obsolete construction before this bridge was designed. In a study for a North River bridge of 3,000-foot span, the late George S. Morison omitted the movable saddle, and attached his cables rigidly to the top of the tower. For the erection of the towers temporary steel wedges are provided which will afford a base sufficiently broad to give stability during erection; or, if it were preferred, the towers could be built with a slight inclination toward the river (sufficient to give a safe margin against overturning by wind pressure) and be tied back to the anchorage until their full height was reached. Four wire construction cables could then be laid from tower to tower, and the towers drawn back to vertical position. Calculation shows, however, that the towers could be run up vertically to their full height on the base provided and still have, because of their great weight, an ample margin of safety against overturning by wind pressure. After the towers are completed, erection cables will be run over the towers from anchorage to anchorage, and from these, traveling erecting cradles will be slung, from which the eye-bars will be lifted up and pinned together, commencing and working out from the towers. The first step would be to string the alternate two and three central eye-bars of each set of twenty, and then slip the other bars over the ends of the pins in pairs until the complete chain was assembled. There is absolutely nothing new about this system of construction, and it has been used for over half a century in the erection of bridges of this type. The web members of the stiffening trusses will be threaded on the pins in their proper relative positions, and then the bottom chord pieces of the trusses will be lifted into place and pinned together at the intersections, after the manner of the erection of any ordinary pin-connected truss bridge.



SECTION THROUGH FLOOR AT CENTER OF SPAN.



THE NEW MANHATTAN SUSPENSION BRIDGE ABOUT TO BE BUILT ACROSS THE EAST RIVER, NEW YORK.

Because of the large ratio of the depth to the length of the bridge of 1 to 8, the rise and fall of 10 inches at the center of the span, due to changes of temperature, etc., will not produce any movement of the eye-bars on the pins. The greatest tendency to movement would be at the towers, but the friction of the eyes on the pins will be so great that the eye-bars will bend before they will turn, and to provide for this, an increased amount of metal has been put in the parts. These stresses are easily calculable, and they have been provided for by increased sections. Consequently, when these massive chains have been hung, they will, as far as any movement of the integral parts is concerned, be as rigid as though forged from a solid piece. The bridge, if carefully erected and systematically painted, should do its work for a thousand years to come.

The anchorage piers are very lofty and massive. They will be pierced by large arches, to provide for street traffic, which will pass through them. They will be provided with stairways and elevators, by which passengers can have immediate access to the bridge at the anchorages, instead of having to go far inshore to enter at the terminal points. The large interior space which necessarily exists in all such large anchorages has, in the present case, been utilized to provide a spacious hall capable of seating 2,000 people. As there will be two of these, one in Brooklyn and one in New York, it is estimated that the rentals alone will be worth more than $30,000 to the city treasury.

When the bridge is completed, and connections with the transit systems made, it is estimated that the eight elevated and street car tracks alone will have an annual capacity of 200,000,000 passengers a year. The estimated cost of the tower and anchorage piers is about $3,000,000, while the superstructure, including the approaches, will cost about $10,000,000. The bridge was designed by Mr. Gustave Lindenthal, in collaboration with Mr. H. Hornbostel, as consulting architect; and a reference to the general design and the detailed plans shows how much can be done to beautify a mammoth structure of this kind without in any way belittling its dignity. If the appropriations are made and the contracts let at once, work can be carried on simultaneously upon the approaches and the towers; and while the erection of these is carried on, the manufacturers can be getting out eye-bars. These could easily be completed by the time the towers were up and the erection wires strung ready for the erection of the cables. By proceeding along these lines, there is no question that the bridge can be finished and open for public use within three and a half years from the present date.

Korea and the United States.

Korean commerce amounts, according to a statement just issued by the Department of Commerce and Labor through its Bureau of Statistics, to about fifteen million dollars per annum. Imports materially exceed exports, and according to the best statement that the Bureau of Statistics is able to obtain, amount to about ten million dollars, and the exports to about five millions. While in the case of China the foreign commerce of the country is carried on chiefly, almost exclusively, through the "treaty ports," this is not the case with reference to Korea, only about one-third of the foreign commerce above referred to passing through the treaty ports.

American products, both manufactured and otherwise, are popular in Korea but the very large proportion reach that country through China and Japan, and the direct trade of the United States with Korea is extremely small. It is only within a comparatively short time that the direct trade of the United States with Korea was of sufficient importance to justify a separate record. In 1897 the exports from the United States to Korea were $509 in value; in 1898, $125,000; in 1902, $251,000, and for the eleven months ending with November, 1903, $366,919, indicating that for the entire calendar year 1903 the total exports to Korea from the United States will amount to about $400,000.

While this is a rapid growth, it does not show by any means the entire value of merchandise from the United States entering Korea. As above indicated, many of these articles from the United States consumed in Korea are sent first to Japan or China and from those countries shipped into Korea. The value of American petroleum consumed in Korea in 1901 is stated at over $300,000; machinery and supplies, $250,000, and electrical goods and lumber, $236,000. These importations of merchandise from the United States were due in part, largely, perhaps, to the presence of Americans engaged in mining operations in Korea and the purchase by them in the United States of machinery and supplies for that work.

The Statesman's Yearbook puts the total trade passing through the "treaty ports" of Korea at ten million yen of imports and about nine million yen of exports in 1897, and in 1901 fifteen million yen of imports, but only nine million yen of exports, thus indicating the growth, especially in imports, which in 1901 were over 60 per cent in excess of those of 1897. These figures, however, relate to the treaty ports only. The value of the yen is about 50 cents, or practically identical in value with the Japanese yen.

The imports are chiefly cotton and woolen goods, metals, kerosene, silk, and machinery for the use of the railways and those engaged in their construction. The chief exports are rice, beans, hide, ginseng, and copper. The currency chiefly consists of copper cash and nickel coins, gold and silver coins being out of circulation. The total currency is stated as aggregating about $22,000,000, of which $6,000,000 is copper cash, $14,000,000 nickel, $1,550,000 Japanese coins, and $530,000 Korean silver dollars.

Eight ports of Korea are open to foreign trade and are classed as "treaty ports." Treaties were made between Korea and the United States in 1882, and in the same year with China; in 1883 with Germany and Great Britain; in 1884 with Russia and Italy; in 1886 with France; in 1892 with Austria; and in 1899 a further treaty with China. Under these treaties Chemulpo, Fusan, Wunsan, Seoul (the capital), Chinampo, Mokpo, Songchin, Masanpo, and Kunsan have been opened to trade. The actual trade through non-treaty ports, however, is, as already indicated, much greater than that through the treaty ports—probably fully double.

The trade of Korea with Japan is growing more rapidly than with any other country, the importation of cotton goods from Japan amounting to from two to three million yen annually. Cotton goods are the largest single article in the value of importations into Korea, amounting to between six and seven million yen annually. Silk goods amount to about one and a half million yen per annum. The chief articles of export are rice, four and a half million yen in value; beans, two million yen; hides, 650,000 yen; and ginseng, 527,000 yen.

The minerals of Korea are of considerable value. Copper, iron, and coal are reported as abundant, and gold and silver mines are being successfully operated, an American company having charge of and operating a gold mine at the treaty port of Wunsan under a concession granted in 1895. Concessions have also been granted to Russian, German, Japanese, and French subjects.

Railways, telegraphs, telephones, and a postal system have been recently introduced into Korea. A railway from the seaport of Chemulpo to Seoul, the capital, a distance of 26 miles, was built by American contractors, and has reduced the time between the seaport and capital from eight hours to one and three-quarter hours. The Seoul Electric Company, organized chiefly by Americans and with American capital, has built and operated an electrical railway near Seoul, which is much used by the natives. This electrical plant is said to be the largest single electrical plant in Asia. The machinery is imported from the United States, and the consulting engineer, a Japanese, is a graduate of the Massachusetts Institute of Technology.

Transportation in the interior is carried chiefly on by porters, pack horses, and oxen, though small river steamers owned by Japanese run on such of the streams as are of sufficient size to justify the use of steamers.

The area of Korea is estimated at 82,000 square miles, or about equal to that of the State of Kansas. The population is variously estimated at from eight to sixteen millions. The foreign population consists of about 30,000 Japanese, 5,000 Chinese, 300 Americans, 100 British, 100 French, 100 Russians, 50 Germans, and about 50 of various other nationalities. The postal system is under French direction and has, in addition to the central bureau at Seoul, 37 postal stations in full operation and 326 substations for registered correspondence.

The New York Automobile Show.

The New York Automobile Show opened at Madison Square Garden on January 16, 1904, under the auspices of the Automobile Club of America, the National Association of Automobile Manufacturers, and the Madison Square Garden Company. We shall review the show in our next issue, which will be our annual Automobile number, and will have an attractive colored cover. The distinctive features of the show this year are the fitting of canopy tops with glass fronts to most of the large touring cars, thus making them serviceable in bad weather; a decided increase in the number of cars with air-cooled motors, upon which are found several new and ingenious systems of air-cooling; and a slight increase in the number of cars employing a three-cylinder motor, which, it is claimed, gives higher efficiency than a four-cylinder. Cellular radiators are much in evidence, and horizontal motors are largely employed, especially on the runabouts. There are but few steam and electric machines, although it is thought the latter will enter new fields of usefulness, equipped with the Edison battery. Some exceptionally large gasoline buses are shown. The number of exhibitors is in the neighborhood of 200, nearly one-half of whom are manufacturers of cars. Still other makers, who were unable to obtain space, are exhibiting at the Herald Square Annex Show at the top of the Macy building. This show will last until January 30, while the Garden show ends January 23.

Rapid Photographic Manipulation for Newspaper Illustration.

An example of how the latest apparatus for quick photographic manipulation can be used to advantage in a novel way was demonstrated last summer by a representative of the Newark Evening News. He was commissioned to be stationed on the revenue cutter "Gresham," to photograph the international yacht race on August 25, 1903, the second day of the race. He took with him a Kodak camera, a Kodak developing machine, the material necessary for developing film negatives, and a number of carrier pigeons.

The yachts were photographed as they crossed the starting line at 11 o'clock A. M. Immediately after taking the picture he placed the developing machine, containing the developer, upon a table on the deck of the vessel, and in broad daylight developed and fixed the roll of exposed film. This was completed in about ten minutes. The finished film negative was hurriedly dried, then rolled up in small compass, and securely wired to a carrier pigeon under the tail, where it would in no way impede its flight. The pigeon was then released, and in exactly an hour and a half arrived at its loft in Newark, N. J.

The negative film was found upon it in good condition, and was at once removed forthwith to the newspaper office, where a print was made, and by 3:48 P. M. a half-tone plate was completed, by the usual half-tone process, placed on the press, and a few minutes later the paper appeared, containing a picture of the morning's yacht races. It was quite a novel idea to utilize the carrier pigeon for transporting picture film for purposes of quick reproduction, and in its way, is more positive than wireless telegraphy. We believe during the siege of Paris in 1870 letters reduced by photography down to extremely small size were transported by carrier pigeons to the outside world, and then enlarged by a lantern upon a screen large enough to read. But that was prior to the days of rapid photography or dry-plate or film machine daylight development.

An Edison Memorial.

Steps are being taken to celebrate the twenty-fifth anniversary of the introduction and commercial development of the incandescent lamp by founding a Thomas A. Edison medal, which will be intrusted to the American Society of Electrical Engineers.

The Institute, through its council, has already accepted the trusteeship of this fund, and the circular which is being issued by the Edison Medal Association announces that it is the intention that the medal shall be awarded each year to the graduating student who shall present the best thesis on some original subject from the universities and colleges of the United States and Canada which have regular courses in electrical engineering. Mr. Edison's mother was a Canadian.

The Current Supplement.

The floating workshop forming part of the new pontoon dock of Durban, described in a recent issue of the SCIENTIFIC AMERICAN, forms the subject of the opening illustrated article of the current SUPPLEMENT, No. 1464. Mr. B. J. Lamme discusses the application of single-phase alternating current for traction and railway service. Lord Kelvin's automatic tide predictor is described in a very instructive article fully illustrated. The grape, raisin, and wine production of the United States is the subject of a paper by George C. Husmann. Prof. A. Forsyth's address on "Universities: Their Aims, Duties, and Ideals," is also published. Mr. N. Monroe Hopkins shows how an electric water-bath for inflammable liquids can be made at home.

A Correction.

Concerning the article on "The Obelisk of Mont Pélé" in our issue of December 5, 1903, it should have been stated that both visits were made by Mr. E. O. Hovey under the auspices of the American Museum of Natural History, instead of one having been made under the auspices of the National Geographic Society. The American Museum of Natural History is now one of the foremost institutions in this country in exploration work, due largely to the liberality of Morris K. Jesup.

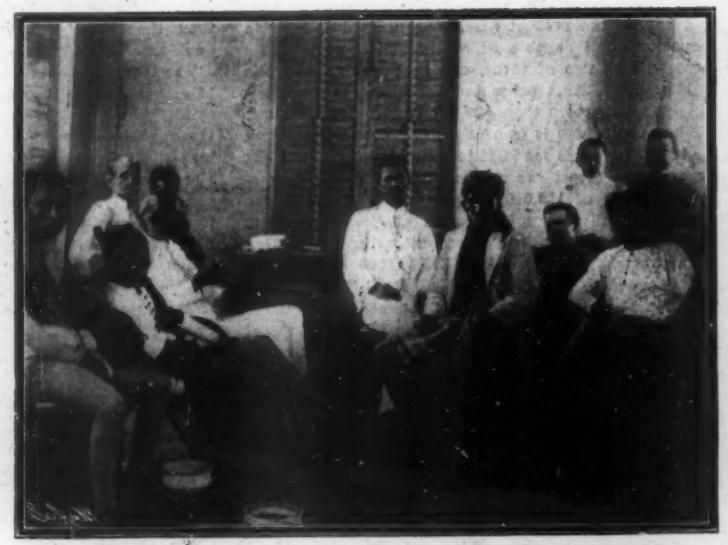
Marbled slabs of colored cement, for use as table-tops, are made by pouring the tinted cement in proper proportions on plates of highly polished mirror-glass, then stirring the paste. When hardened, it is removed from the glass. The pieces thus obtained have a polished surface that can be improved upon by brushing with a diluted solution of potassium silicate.

Type of Moro Warrior.

The Rarest Fruit in the World.

One of the Streets of Jolo.

A Native Jolo Hut.



Gen. Bates and the Sultan of Jolo. A Meeting During the Treaty Negotiations.

The Gates of Jolo

Natives of Mindanao, Zamboanga, Philippine Islands.

The Town of Jolo, a Curious Combination of Spanish and Native Architecture.

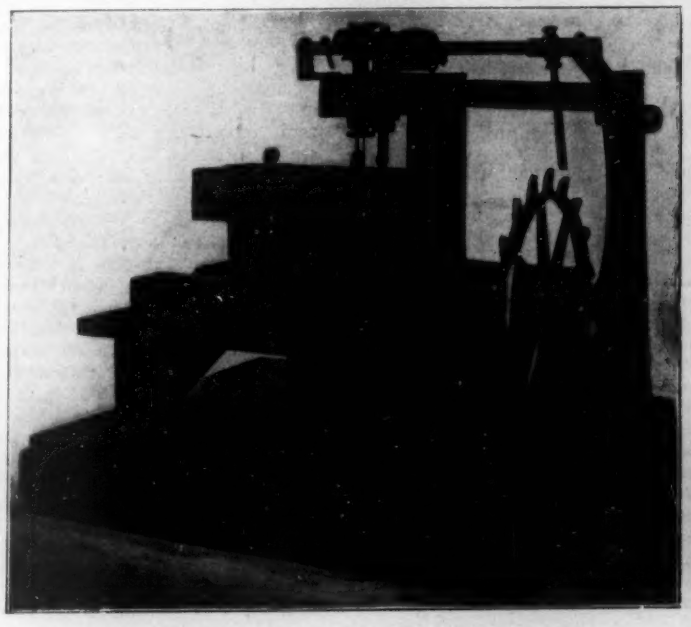
SCENES ON THE ISLAND OF JOLO AND THE PHILIPPINES.—[See page 66.]

THE INVENTION OF THE SEWING MACHINE.

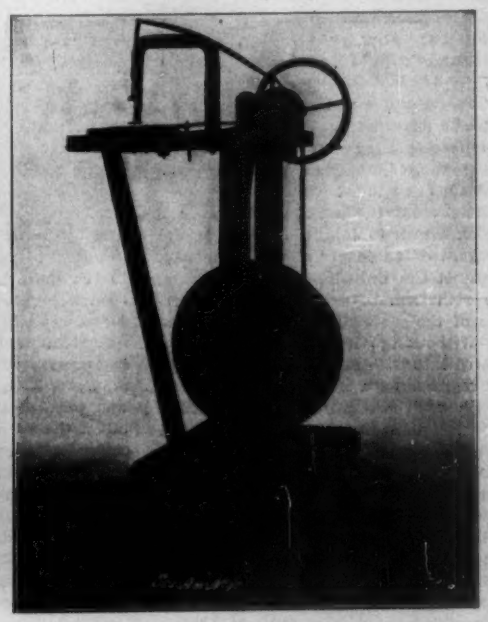
BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An attempt was made as far back as 1775 to accelerate hand sewing, which is limited to about forty stitches per minute, by the patent needle invented by C. F. Weisenthal. This needle, instead of having the eye for the thread at one end and the point at the opposite extremity, as is the practice in the existing hand-sewing needle, was pointed at both ends, and had the eye in the center. With this needle it was not necessary to turn the needle over when sewing. Strange to relate, this system has been adopted in some sewing machines, the needles being pulled and pushed over by the aid of mechanical pincers.

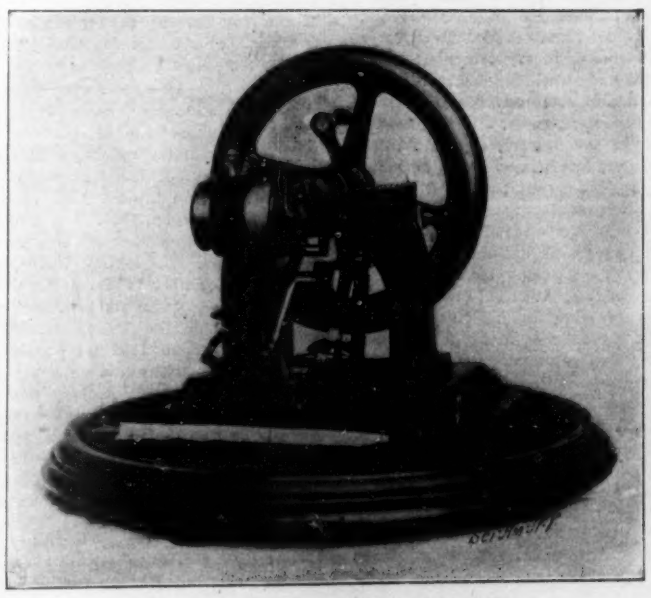
The first practical sewing machine, however, was invented in 1790 by Thomas Saint, a cabinet maker, of London. It is not known whether he ever built a practical machine. But he compiled a very comprehensive specification and set of drawings, and patented his machine. It may be seen from our illustration of Saint's machine, which was constructed several years ago from the inventor's designs, that many of its features are present in the modern types of sewing machines. The Saint machine is of the chain-stitch, or single-thread, type. It consists of a table with an overhanging arm, which feature it will be observed is retained in the modern sewing machines, and a horizontal shaft. The latter, through the medium of a ratchet wheel, reciprocates a vertical needle bar. The machine appears to have been intended chiefly for leather work. It was provided with an awl working vertically, which pierced a hole for the thread. A spindle and projection laid the thread over this hole, and a descending forked needle pressed a loop of thread through it. The loop was caught on the underside by a reciprocating hook; a feed moved the work forward the extent of one stitch, and a second loop was formed by the same motions as the first. It descended, however, within the first, which was thrown off by the hook as it caught the second, and being thus secured and tightened up, an ordinary tambour or chain stitch was formed. Saint, however, apparently did not proceed with the development of his sewing machine idea, for a few years later he devoted his energies to steam boilers. It was not till some forty years after Saint had obtained his patent, in 1790, that any decided attempt was again made. In 1830, Barthélemy Thimonier, a tailor of St. Etienne, in France, patented his device, and he followed it up with great assiduity.



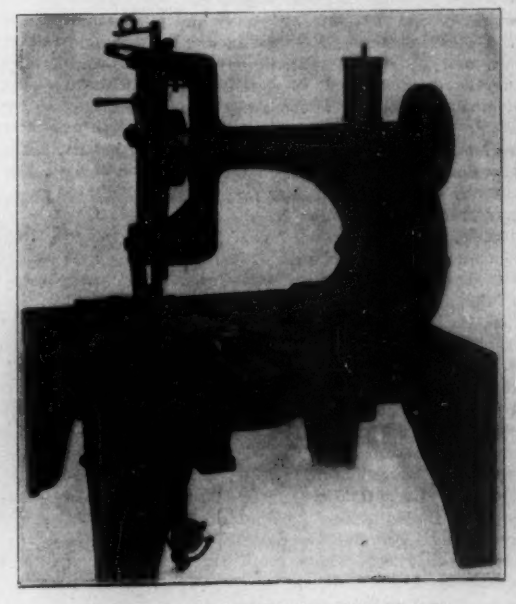
Sewing Machine Invented in 1790 by Thomas Saint of London.



English Sewing Machine Built in the Early Part of the Nineteenth Century.



Elias Howe's Sewing Machine, Built in 1846.



First Singer Sewing Machine, Made in 1851.

THE INVENTION OF THE SEWING MACHINE.

In Thimonier's apparatus the needle was crocheted, and descending through the cloth, it brought with it a loop of thread, which it carried through the previously made loop, and thus it formed a chain on the upper surface of the fabric. The machine was a rather clumsy affair, made principally of wood. As many as eighty were being used in Paris in 1841, making army clothing. Hostility to the invention was great, and an ignorant and furious crowd wrecked the establishment, and nearly killed the unfortunate inventor. Thimonier, however, was not discouraged, for in 1845 he twice patented improvements on it, and in 1848 he obtained both in France and the United Kingdom patents for further improvements. The machine was then made entirely of metal, and was a great improvement on the wooden model. But the revolution of 1848 blasted his prospects, and he died in obscurity in 1857.

The eye-pointed needle and a double thread or lock-stitch were invented by Walter Hunt, of New York, in 1832 to 1835, and by this needle a loop of thread was formed under the cloth to be sewed, and through that loop an oscillating shuttle was passed, thus making the lock stitch of all ordinary two-thread machines. Hunt really produced a practical machine, but he failed to protect himself until 1853, when his claim to a patent was disallowed on the ground of abandonment.

Elias Howe first commenced work on the sewing machine in 1844, and in 1845 he made a thoroughly successful machine, and in the next year he obtained a patent, which was to bring him wealth, for in 1863 his royalties were $4,000 a day.

Our illustration shows the first successful machine invented by Howe, and it differs from both Saint's and Thimonier's inventions in almost every particular. It was of the lock-stitch type, and the work to be sewed, instead of lying horizontally, hangs vertically, being fixed on pins embedded in the edge of a thin metal baster plate, which can be bent to the curve of the seam to be sewed. The baster plate is drawn through the machine by the teeth of a pinion, the motion being intermittent, and thus carries the cloth forward in front of the needle.

The needle is curved, and the eye is placed near its point. The thread passes from a spool above, and down through the eye. The needle is attached to a pendent vibrating lever, and when the point has passed through the cloth a certain distance, and is just returning, a shuttle, containing a bobbin of thread, sliding in a shuttle race, passes through the loop that extends from the cloth to the eye of the needle, leaving the shuttle-thread in the loop. The needle then rises, and both threads are pulled taut, with the needle thread in front of the cloth, and the shuttle-thread behind, but both threads cross in each hole made by the needle. Although the needle swings in a vertical plane, it passes through the cloth horizontally. The shuttle travels to and fro horizontally with the point, or nose downward, being driven from end to end of race by two strikers which are operated by arms and cams secured to the main shaft.

As will be seen, this machine bears but little resemblance to any of the modern machines, but it embodied the three essential features which characterize almost all practical machines, viz., a grooved needle with the eye at the point, a shuttle operating on the opposite side of the cloth from the needle to form a lock stitch, and an automatic feed.

But although the foregoing men are accepted as the pioneers of the sewing machine, an interesting relic, a home-made amateurish sewing machine, is now preserved in England. It is a most primitive apparatus, constructed for the most part of wood. It was made by Charles Kyte, a native of Snow Hill, near Evesham. The date of its origin is unknown, though it may have been made before the birth of either Saint's, Thimonier's, or Howe's ideas. The machine consists of a four-legged wooden stool supporting a table upon which the machine itself is carried. The treadle serves to actuate the machine by means of a cranked axle carrying a wooden flywheel, weighted near the circumference by lead run into bored holes. On the spindle of the machine is a small pulley driven by a belt from another pulley on the flywheel, while a crank in the spindle imparts the vertical reciprocating motion to the needle bar through a long rocking lever. To the side of the upper pulley is fixed an eccentric steel ring which acts as a cam, and gives motion to a long arm which works the shuttle-carrier. On the opposite side of the crank working the needle bar is a small cam giving a side motion to a horizontal rocking lever feeding forward the work to be sewn. On the table is a light flat spring, fitted with a small

pulley, and this appears to have been used as a tension. Unfortunately, the needle and shuttle of this curiosity are missing, and their form is unknown.

In 1851 the Singer machine was invented. Like the Howe, this latest device was of the lock-stitch type, and the shuttle works transversely by a carrier having a V-shaped slot on its side, in which a crank pin attached to the underneath shaft moves. A crank pin on the upper shaft, working in a V-shaped slot in the needle bar, supplies the needle motion. The needle thread tension is adjusted by altering the extent to which the thread is coiled round a smooth wire, and the thread is held at the commencement of the down stroke by an additional tension applied by a cam at the back of the crank plate. It has a wheel-type feed, the feed wheel being moved intermittently by a band, worked by a rocking lever from a cam on the underneath shaft, sufficient friction to obviate the backward motion of the feed wheel during the return of the band being given by means of a wooden brake block.

THE PHONOGRAPH AND HOW IT FIGURED IN THE TREATY OF JOLO.

BY R. C. ROST.

Just half way round the world from Washington, D. C., to the extreme south of our Philippine possessions, lies a group comprising eleven small islands, all of which are inhabited, together with many adjacent smaller islands, some of which have never been explored. At present the attention of the civilized world is being drawn to Jolo, the largest island of the group, because of an insurrection on the part of the natives against the United States government. The treaty made with Gen. Bates in 1899 will be remembered as one of the most remarkable in the annals of history. Without the loss of a single life, a compact was entered into with the rulers of the different islands, who represented a million and a half of people, and that without the cognizance of the Sultan of Jolo, whose jurisdiction was supposed to extend throughout the entire group. Thus forced to see the futility of withstanding the United States government, he also finally agreed to the conditions of the treaty.

The city of Jolo, on the island of like name, is the American capital. Maibun, on the opposite side of the island, is the Moro seat of government. These Moros represent the true Indian type. They are semi-civilized, and very treacherous. Of piratical tendencies, their territory, even to the present day, is regarded with dread. They never eat meat, but subsist upon a diet of rice, fish, fruit, and vegetables, and yet withal are perfect types physically. Both sexes wear a trouser-like garment, that affected by the man fitting skin tight. I asked a Moro how he got in and out of the clothes, and he replied that they were sewed on and never removed until they fell off. Polygamy is universally practised, and slavery exists very extensively. Horse stealing is punishable by death; murder by a fine of about fifty dollars. The religion is Mohammedan, and as practised on the islands gives rise to many queer customs. For example, a Moro without any previous preparation for the calling will suddenly declare himself "juramentado," that is, inspired by Mohammed to be a destroyer of Christians. He forthwith shaves his head and eyebrows, and goes forth to fulfill his mission.

Shortly after Gen. Bates' arrival on the island, the sultan sent word that there were some half dozen juramentados in Jolo over whom he had no control. The general replied, "Six hundred of my men have turned juramentado, and I have no control over them." Thus for the time being at least did the juramentado element cease to exist. Within the past few months, however, another juramentado has come to light. He succeeded in getting into the city of Jolo, where he seized a member of the 17th United States Infantry, and promptly disemboweled him. The murderer was caught in the act by a sentry on guard, who instantly dispatched him. Unfortunately, the bullet also killed a Moro, the chief bugler of the regiment. It was decided to make an example of the juramentado. Accordingly, a grave was dug without the walls of the city. Into this the murderer was unceremoniously dropped. A pig was then suspended by his hind legs above the grave, and the throat of the animal cut. Soon the body lay immersed in gore, the direst calamity that could happen to a Moro, his religion teaching him that contact with pig's blood means exclusion from heaven. A guard stood sentry over the grave until dusk, when the pig was buried side by side with the juramentado. This so enraged the Moros that they besieged the city. Matters became so grave that Gen. Wood felt called upon to disperse the mob, resulting in the death of a number of Moros. This uprising on the part of the natives entirely abrogates the conditions of the Bates treaty made in 1899 under the most diplomatic conditions. The general first visited each of the surrounding islands, and invited its chief on board the cruiser "Charleston," which the Navy Department had placed at his disposal. There the guest was treated to entertainment of a liquid nature, and incidentally presented with a great sack containing one thousand Mexican dollars, in bulk as much as two men could carry. The manner of the presentation was most dramatic. As the bearers dropped their burden, the mouth of the bag opened as if by accident, and the coin rolled forth at the feet of the recipient. Before leaving the ship the visitor was prevailed upon to sign the treaty. Oftentimes we found it necessary to travel several miles inland in order to reach the chief. On these expeditions we went totally unarmed by order of Gen. Bates, who thereby showed great judgment. Trouble must have resulted on more than one occasion had we been provided with fire-arms.

Our interpreter was a white man, Edward Schuck by name. As a linguist he excels, speaking fully a dozen languages with great fluency.

At last there remained but the sultan himself to be interviewed. This proved to be a difficult matter, for upon hearing of the arrival of the vessel of war in the harbor of Jolo, the sultan promptly departed for Maibun. In vain representatives of Gen. Bates were sent on shore to request his royal presence on board. At last the "Charleston" sailed for Maibun. Once more the general's representatives went on shore to invite the sultan to the warship. Most positive was the refusal. A second invitation was treated in like manner. Weary of diplomacy, Gen. Bates sent, ordering the sultan to appear, and upon his ignoring of the command, the decks were cleared for action, aim was taken at the rocks alongshore, and the first discharge not only filled the air with flying rock, but it also sent the curious Moros, who had crowded to the shore in hundreds, rushing and screaming, as though bereft of their senses, into the shade of the forest beyond. It convinced the sultan, too, that he had better accompany the officers to the ship; and so, in company with his many retainers and a great show of pomp, he boarded one of his own war canoes, and was paddled to the "Charleston." Each visitor had taken the precaution to supply himself with a great sack of rice, under the weight of which he fairly staggered up the gang ladder. All had evidently come prepared to make a protracted stay. It is safe to say that the events which happened on board the "Charleston" during the next few hours will never be forgotten by those present. The royal guests were conducted over the man-of-war. Food they refused as coming from the hands of Christians, but drink they took freely. Great was their wonderment at the things which they saw. At the suggestion of an officer, the sultan touched an electric button; instantly a Chinese servant appeared as if by magic. Again, under directions, he operated the button, this time twice, and behold a United States marine stood in the doorway. From that time on, every ornament aboard ship that in any wise suggested an electrical button was pushed by the Sultan or some member of his suite. He was conducted into a dark room, and told to turn the button that adjusted the lighting apparatus. The flood of light that resulted left him with gaping mouth and dilated eyes. His wonderment continued to grow apace throughout the entire afternoon; whenever opportunity afforded, the Sultan of Sulu repeated the performance of pushing electric buttons and turning electric lights on and off. He even went so far, when he thought himself unwatched, as to try to appropriate one of the bulbs aglow with light. But the funniest thing of all was when the mighty chief, upon invitation, fired the Colt's automatic gun. The explosion of the first discharge seemed to root him to the spot. His hands still gripped the trigger, with the result that shells continued to pepper the surrounding waters. Again and again the royal gunner begged that they stop the action of the infernal machine, not knowing that the medium of cessation lay in his own hands; so thoroughly frightened was the sultan, it was impossible to make him loosen his hold, and an officer ordered the cutting of the tape, thus stopping the supply of ammunition. The one-pounder was next brought into play, and at the first loud boom the sultan called the ammunition display off, refusing to go near one of the eight-inch guns, which he had also been invited to fire. In the meantime his attendants, whose knives had been magnetized, conceived the idea that the Evil One himself was aboard. They begged and implored to be taken on shore, and quite forgetful of their bags of rice, they scurried down the gang ladder. At night the searchlight was brought to bear upon the Moro town of Bus Bus; the instant desertion of the town followed, even to the dogs, and for many weeks thereafter no amount of persuasion could induce the inhabitants to return.

Gen. Bates made his headquarters in the town of Jolo, and thither the sultan and his staff came on several occasions to discuss the treaty; subsequently another visit was made to the "Charleston." This time the mother of the sultan accompanied the party. A phonograph owned by one of the officers rendered very pleasing selections for the entertainment of the guests. The aged dame sat entranced throughout the performance. It was not until the time came for her son to affix his signature to the treaty that she awakened. Under one condition only would she permit the sultan to sign—the phonograph must become hers at once. For a time that phonograph threatened to be the means of upsetting all of Gen. Bates' well-laid plans for the amicable taking over of the islands. Fortunately, the owner was prevailed upon to part with the machine in the interests of his government, and the coveted music producer changed owners at the signing of the treaty by the sultan.

The island covers fully three hundred and twenty square miles. It is of coral formation, and offers a most excellent harbor to the west. In topography it is gently undulating and covered throughout its entire length by the rankest tropical vegetation, valuable teak wood being found extensively throughout the entire district. Nowhere in the world are more luscious fruits produced. Among those peculiar to this belt is the durian, which is about the size of a muskmelon. Its exterior presents somewhat the appearance of a chestnut burr, being prickly and tough; within, the fruit is white and cheese-like, and owing to this peculiarity the American soldiers dubbed it the "vegetable limburger." The mangosteen is another of the rare fruits. It is the size of an average orange, chocolate colored, and has a very brittle skin. Inside, four white sections contain a colorless liquid. This is the rarest fruit known, and the only one, so it is claimed, that Queen Victoria had never tasted, there being no way of preserving the fruit for a sufficient period after plucking to permit of shipping to any distance. The hemp plant is also indigenous to these islands, the making of hemp being one of the chief occupations. In appearance the tree is just like the ordinary banana, a single hand of fruit growing forth from the top of the central stalk. The fruit is extremely bitter and is filled with numberless round, black seeds.

The origin of the town of Jolo does not lack in interest. Some fifty years ago an army officer, a man prominent in the politics of Spain, was exiled by order of the crown. His sentence doomed him to spend the rest of his life on this island in the Pacific. Being a man of great resource, he determined to lay out for himself a walled-in city. He accomplished his task after many years of arduous labor, and when his king heard of the manner in which the condemned man had spent his long period of servitude, he pardoned him. These very same walls we find to-day guarded by an American sentry. Just without the walls is the spear market, where all Moros desirous of entering the city proper are obliged to leave their weapons. This was a Spanish custom, and is enforced by the American authorities at the present day.

A 1905 International Exposition.

The one-hundredth anniversary of the exploration of the Oregon country by Capts. Meriwether Lewis and William Clark, of the United States army, will be celebrated by an international exposition, to be held at Portland, Oregon, 1905. Lewis and Clark were commissioned by President Jefferson. Their exploration added Oregon, Washington, Idaho, and parts of Montana and Wyoming to the national domain, and gave to the United States its first foothold on the Pacific Ocean. In 1850, the Oregon country had a population of but 13,294. In 1903 its population was 1,500,000. The exposition will afford an opportunity for studying the history, progress, sociology, and economic development of a section of our country that is comparatively little known to the East. Historically considered, for example, the acquisition of the Oregon country paved the way for the subsequent annexation of California. The cities of Portland, Seattle, Tacoma, and Spokane are examples of the progress of the region. Where Portland, with its 125,000 people and its annual jobbing trade of $175,000,000, stands to-day, Capt. Clark in 1806 found a few miserable Indian huts. Puget Sound, which was little known for nearly forty years after Lewis and Clark returned to St. Louis, is now one of the world's greatest harbors.

A Ninety-Mile-an-Hour Automobile Speed Record.

Henry Ford, on January 12, with his remodeled racer, fitted with a new 70-horsepower motor, beat all existing records for the mile by a wide margin in a speed trial over a specially-prepared course on the ice of Lake St. Clair. A track several miles in length was prepared by scraping the snow off the ice and sprinkling it with cinders. The machine swerved and bumped about considerably, but made the remarkable time of 39 2-3 seconds.

A British Firing Record.

During the recent prize firing by the Channel fleet at Gibraltar H. M. S. Majestic, flying the flag of Vice-Admiral Lord Charles Beresford, made an astonishing record with her four 12-inch guns. She made 17 hits out of 23 for 37 rounds.

A BOTTLE HOUSE.

This house is one of the most remarkable ever constructed, for it is really composed principally of glass bottles. It stands in the town of Tonopah, Nevada, and was erected by a miner who used the bottles on account of the scarcity of other material. The bottles were placed in rows with the bottom ends outward, as shown in the photograph, and are held in place by mud in place of plaster. The corners of the building are composed of wooden beams, also covered with mud. The walls are about a foot in thickness, and are so well constructed that the house is actually more comfortable in winter than many of the other dwellings in Tonopah, which are built of other material. It is 20 feet in length, 16 feet in width, and contains two rooms. It was built entirely by the owner, a miner named William F. Peck.

A BOTTLE HOUSE.

The "Sleeping Sickness" in Africa.

According to a statement issued by the American Board of Commissioners of Foreign Missions, no less than 68,000 persons have died of the curious sleeping sickness which has ravaged Africa, 10,000 having perished within the last five months. Notwithstanding all efforts on the part of the British authorities, there has been no abatement in the spread of the disease in Uganda. The sleeping sickness made its appearance in that section two or three years ago. A commission sent from England, headed by Col. Bruce, has decided that the disease is scattered by a fly called *kivu*, but no antidote has yet been discovered. Another commission is said to be in prospect to see what can be done to prevent the spread of the plague. Segregation seems impossible, and no relief is in sight.

The first symptom of the presence of the disease is headache, with swelling of the glands of the neck, followed by protracted sleeping on the part of the patient. The disease runs its course in from six weeks to two years.

A REAL LOG CABIN.

BY ARTHUR INKERSLEY.

On the Marble and Middle Fork Divide of the Kaweah River, California, there is a noble forest of sequoias, of which Mr. John Muir, the well-known naturalist and mountaineer, writes: "After a general exploration of the Kaweah Basin, this part of the sequoia belt seemed to me the finest, and I then named it the 'Giant Forest.' It extends, a magnificent growth of giants grouped in pure temple groves, ranged in colonnades along the sides of meadows, or scattered among the other trees; from the granite headlands overlooking the hot foothills and plains of the San Joaquin back to within a few miles of the old glacier fountain at an elevation of 5,000 to 8,000 feet above the sea."

In this region Mr. Muir came across a man who was herding a band of horses that had been driven up a rough trail from the lowlands to feed on the forest meadows. When Mr. Muir, whose scanty supply of food was running very low, asked if he might have some flour, the man said, "Yes, of course, you can have anything I've got. Just take my track and it will lead you to my camp in a big hollow log on the side of a meadow two or three miles from here. I'll be back before night; in the meantime, make yourself at home." By the middle of the afternoon Mr. Muir had discovered "his noble den in a fallen sequoia hollowed by fire—a spacious log-house of one log, carbon-lined, centuries old, yet sweet and fresh, weather-proof, earthquake-proof, likely to outlast the most durable stone castle, and commanding views of garden and grove grander far than the richest king ever enjoyed." The mountaineer soon came in, and he and John Muir enjoyed a talk on trees, animals, etc., while he busily prepared the evening meal.

Mr. Muir wandered about for several days within a radius of six or seven miles of the camp, studying the surrounding country and at last regretfully bade goodbye to his host, "the kind sequoia cave-dweller," as he called him.

A REAL LOG CABIN.

Dispersing Fogs by Electricity.

In the course of a recent lecture before the Physical Society of Great Britain, on "The Means of Electrifying the Atmosphere on a Large Scale," Prof. Oliver Lodge demonstrated that by the discharge of electricity into the air in large quantities fogs may be dispersed, as the particles of mist and smoke coalesce, or cohere, under influences of this medium, and fall to the ground. Prof. Tyndall proved that a heated body placed in an atmosphere clouded with dust formed around it a dark space, which was dust-free. He thought that the hot body consumed the dust, which in his experiment was organic. Investigating the phenomenon twenty years ago, however, Prof. Lodge found that Tyndall's theory was wrong—that there was a sort of aerial bombardment from the heated body which kept the dust at a certain distance, but he also discovered that when electricity was substituted for heat the particles acquired polarity, ran together, and were repelled to the sides of the vessel. This fact induced him to advance the theory that by electrification of a misty atmosphere fog could be dispersed. A trial was made at Liverpool, where Sir Oliver was then professor of physics. The air around University College was electrified by means of a Wimshurst machine, the current being most effectively dispersed by the aid of flame at the summit of a tall mast. The result was that in a dense fog a space of fifty or sixty yards radius was kept quite clear. Sir Oliver Lodge fruitlessly endeavored to induce the Mersey Dock Board to place a sufficient number of stations on both sides of the river, and by electrifying the air on one side with positive, and on the other with negative electricity, to discover if the fogs on the stream, which are always accompanied by collisions, could not be got rid of. Sir Oliver has followed up this subject, and has now suggested the utilization of an improved kind of dynamo, instead of the Wimshurst machine, to give a continuous, and not an alternating, current of electricity. He illustrated the principle of his thesis by a large glass bell filled with dense magnesium smoke. He then electrified the air within the jar, and the smoke particles cohered and fell like so much snow, the air at the same time clearing. Given the means of electrifying a cloud, Sir Oliver Lodge saw no reason why its watery particles should not be forced into drops, and made to fall as rain.

The Strength of American Timbers.

Timber tests which shall determine the strength of the principal American timbers used for construction purposes are now in progress at Washington, D. C., at Yale University, New Haven, Conn., at Purdue University, Lafayette, Ind., and at the University of California, Berkeley, Cal. These tests are made under the direction of the Bureau of Forestry, and are for the benefit of lumbermen, construction engineers, and scientific men who are interested in the strength of different wood fibers. The Bureau of Forestry plans from the results of its tests to make tables of the strength of different American woods to which the engineer may refer when he wishes to know what timbers to use for certain purposes. The tests will be in cross bending and breaking, compression with and against the grain, and shearing.

No complete and satisfactory series of tests on large sticks of timber has ever been made in this country. Lumber manufacturers in the South and the Pacific Coast States are especially interested in this work, since they wish to know more about their product. They have contributed gratis much of the material used in the tests.

The chief timbers now being tested are the Southern pines and the red fir of the Pacific coast. In the laboratories at Washington tests are now in progress on loblolly pine sticks 17 feet long and 8 by 14, 8 by 8, and 8 by 4 inches. Special attention is given to the effects of moisture on the strength of wood. In the case of loblolly pine which has grown rapidly, the strength was found to decrease 50 to 60 per cent after the dry wood had been soaked several days in water. The fact, however, is not yet established and will have to be proved by further experiments. The timbers tested are of the usual grades purchased in the market and are not selected pieces.

At the laboratory of the Yale Forest School in New Haven small selected pieces of longleaf pine, without knots or other defects, are being tested so as to learn what is the ultimate strength of the fibers.

At Berkeley, Cal., tests are being made on red fir from timbers contributed by red fir manufacturers.

Dr. W. K. Hatt, who is stationed at Purdue University, is carrying on a series of tests there with hardwood timbers and is preparing for publication the results of all the tests of the bureau.

A Sliding Railway.

The novelty of high-speed railway construction described in the Revue Technique by M. G. Sautereau consists in doing away with the running wheels of the cars and replacing them with slippers or skates. The cars are raised on a thin film of water, which is forced under the skates through a jet. In the earlier plans the propelling force contemplated was a horizontal jet of water, which was directed against suitable vanes on the bottoms of the cars. The valves of these jets were opened by the leading car and closed by the rear one. In the plan as at present proposed, a third rail is laid between the two gliding rails, and a friction wheel, driven by electric motors, runs on this and furnishes the propelling force. The advantages claimed for this system of traction are a great reduction in the track resistance and in the power required by a car, a much smoother running of the cars, and hence a smaller depreciation on both of track and car. There is no danger of derailment, and high speeds can be attained. By cutting off the water supplied under the skates, a great braking effect is secured. Figures are given to show the economy of the system over electric traction on wheels.

The cost of the first census taken of the population of the United States was not quite $45,000. The cost of the census taken in 1900 was $13,115,439. The cost of the first census per head of the population was a little over 1 cent; in 1900 the average cost had risen to 17 cents. The decided increase in the cost is explained by the great extension of the census and of the details associated with it.

RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

AUTOMATIC SUCTION-PUMP OR VACUUM-CHAMBER.—C. H. WETTLIN, Asbury Park, N. J. This apparatus removes obstructions in water-pipes, but is otherwise applicable where sudden and powerful suction is required. The vacuum for producing suction is produced by decomposition and explosion of some substance supplied to the chamber of a drum or cylinder. The drum has a holder for the explosive substance, means for controlling its admission to the chamber, and electrical means for producing ignition of the substance, while within the chamber is a device for distributing it, so as to produce a more effective explosion and powerful vacuum.

CONCENTRATOR.—L. F. SCHOENEFELDT, Denver, Col. In this case the invention relates to improvements in machines for separating the values from dry crushed ores, dry gravel, dry sand, an object being to provide a concentrator operating by centrifugal action that shall be light, strong, and durable, easily operated, and while taking up a very little space will provide for a large output.

Heating and Lighting.

STOVE.—F. J. PIOCH, Creston, Iowa. Efficiency in heating and in ventilating the fire, and easy removal of ashes, are among the objects of this invention. There are no idle corners in this stove in which ashes and dirt may accumulate. Air passing all around the fire-pot obviates all danger of burning out the pot and the degree of heat given the air is so intense as to increase the efficiency of the stove to a marked extent.

Machines and Mechanical Devices.

TUBE OR ROLL FORMING MACHINE.—C. BURMANN and R. D. DOUGLAS, Fall River, Mass. Primarily the inventors have in view the production of a machine the sections whereof forming the mandrel will be capable of being readily moved toward or from each other, thus enabling the tube or roll at all times to have a positive bearing inside the same, yet when it is desired to remove the tube from the mandrel the latter's circumference may be decreased, whereby the roll may be easily slipped from the same.

Of Interest to Farmers.

HAY-KNIFE.—W. S. SHIPPY, Bayfield, Col. This knife is capable of being used by the hand or foot, or both if desired. The main feature of its construction is that it needs to be raised only about six inches to feed and cut the whole length of the knife, while knives of similar character must be raised nearly, if not wholly, their entire length to cut and feed properly.

CATTLE-STANCHION.—W. T. EDWARDS, Elkhorn, Wis. This improvement refers to stanchions employed for holding cattle while milking or for other purposes which require a certain number of cattle to be separated from a herd and held spaced apart by an engagement of their heads and necks with parts of the stanchions. The object is to provide details of construction for a stanchion which will adapt the device for holding cattle by their necks and permit release either individually or all at a time.

CORN-SHOCKER.—T. L. CREATH, Mount Sterling, Ohio. The invention relates to an apparatus intended principally for forming shocks of corn and depositing them in upright position in the field, the apparatus being attached directly to the harvester by which the corn is cut. It also relates to an arrangement of the harvester-frame, the draft apparatus being rearward of the front end of the harvester and the horses walking one at each side thereof.

Pertaining to Vehicles.

NECK-YOKE ATTACHMENT.—D. N. LUSE, Carroll, Iowa. By the construction of this attachment the yoke can swing freely to the front and rear and can turn at its center upon the swinging bar, giving freedom of movement to the yoke and properly supporting the front end of the pole. The yoke is so connected with the pole that the invention avoids any projection of the pole beyond the neck-yoke connection, obviating difficulties resulting from the catching of checkreins over the pole ends and the interference by the projecting end of the pole striking animals, end-gates, etc. It can be employed upon carriages or wagons or any other implement-tongue.

WHEEL.—J. B. MCMULLEN, Howard County, Md. Mr. McMullen's invention is an improvement in wheels, and particularly in pneumatic-tire wheels, and has for its object to provide a novel construction of devices for securing the tire and for operating the securing devices. It comprises means to forcibly operate the side plate into and out of engagement with the wheel by a simple appliance, which may be applied to and removed from the wheel at pleasure.

Miscellaneous.

HOSE-SUPPORTER.—FRANCES C. MCDONALD, Box 390, Chicago, Ill. In carrying out the present improvement the inventor has particularly in view the provision of a device which will firmly and securely retain the upper edge of the stocking through the medium of a locking device, which forms an important part of the invention. This garment-supporting device is exceedingly simple in its construction and positive in its operation, while embodying the essential features of cheapness and convenience.

HATCH-COVER FOR MARINE VESSELS.—W. W. DAWLEY, Geneva, Ohio. In modern vessels hatches are made so heavy as to render their movement very laborious. Mr. Dawley seeks to overcome this disadvantage by employing a carrying wheel or wheels for the hatch-cover, and means for raising the cover on or lowering it from the support of the wheels. The cover may be lowered down on the hatch to close it, and to uncover the hatch the cover is raised until supported by the carrying-wheels, and the cover and wheels run along the deck until the hatch is quite uncovered.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
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"U. S." Metal Polish. Indianapolis. Samples free.

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AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 4995.—For manufacturers and promoters of suburban electric railways.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

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Inquiry No. 4997.—For machines for weaving wire and wood picket fencing.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 15, Montpelier, Vt.

Inquiry No. 4998.—For quotations on 100 and 1,000 of a cheap grade of compressible rubber bulbs, with 1 foot of ¼ rubber hose attached, such as used on atomizers.

American inventions negotiated in Europe. Felix Hamburger, Equitable Building, Berlin, Germany.

Inquiry No. 4999.—For wholesale dealers in Indian beads.

Edmonds-Metzel Mfg. Co., Chicago. Contract manufacturers of hardware specialties, dies, stampings, etc.

Inquiry No. 5000.—For dry placer washers for gold mining.

For Machine Tools of every description and for Experimental Work call upon Garvin's, 149 Varick, cor. Spring Streets, N. Y.

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The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 5003.—For makers of machinery for putting wires in shipping tags, also firms making those tags.

Empire Brass Works, 106 E. 129th Street, New York, N. Y., have exceptional facilities for manufacuring any article requiring machine shop and plating room.

Inquiry No. 5004.—For machinery for a steam laundry.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5005.—For manufacturers of wire-easels.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 5006.—For the manufacturers of the Star magnifying paper weight.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits, Early American illustrated Magazines, Early Patents signed by Presidents of the United States. Valentine's Manuals of the early 40's. Correspondence solicited. Address C. A. M., Box 773, New York.

Inquiry No. 5007.—For parties to manufacture, in quantities, a flat, indelible pencil about 3¾ inches long when inclosed in a nickel-plated metal case, and having an imprint stamped on this case.

Inquiry No. 5008.—For parties engaged in raising skunks.

Inquiry No. 5009.—For manufacturers of small leather washers ⅜ inch inside and 9-16 outside.

Inquiry No. 5010.—For manufacturers of chain adders.

Inquiry No. 5011.—Wanted, oboe and bassoon gouging machines and tools for making the reeds for same. Also for makers of brass staples for the oboe.

Inquiry No. 5012.—For manufacturers of a movable drag saw operated by horse power, with hollow shaft, made in several sections and telescopes, so that the saw can make several cuts from a tree or log at one setting.

Inquiry No. 5013.—For makers of gage wire stitching or stapling machines.

Inquiry No. 5014.—For makers of machines for making shot.

Inquiry No. 5015.—For a machine for making cement bricks, of capacity of 5,000 bricks daily.

Inquiry No. 5016.—For makers of drop forgings for dental forceps.

Inquiry No. 5017.—For dealers in Indian seed beads, and all classes of fancy olivo, spar, jet, pearl and Venetian beads, at wholesale.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9286) F. B. asks: You no doubt have been asked the question regarding the man and the squirrel—the squirrel keeping on the opposite side of the tree from the man as he walks around the tree. Does the man walk around the squirrel? It seems to me a foolish question, but I would like your answer to settle a dispute. A. We have answered the man-and-squirrel question so many times, in our columns, that we supposed every one had seen it. If a man walks around a tree he also walks around everything upon that tree whether it is in motion or at rest upon the tree. This seems so plain that there need be no question of its correctness. Any other conclusion seems to us entirely absurd and illogical.

(9287) M. D. P. asks: Will you kindly let me know through your valuable paper if No. 30 or 31 (Brown & Sharpe's) gage soft copper wire will work on an induction coil described in SUPPLEMENT No. 160; if not, what size will I have to use? A. The description of the coil in SUPPLEMENT No. 160 states that No. 36 wire should be used in the secondary winding. We should now advise that it be silk covered rather than bare wire as was used in the original coil. The practice has changed since that paper was published. It is a long time since the paper was published and many changes have been made in the construction of coils. The extensive demand for X-ray and wireless telegraphic apparatus has required many thousands of coils.

(9288) E. B. W. asks: I wish to know if iron, steel or copper plates will deteriorate when in contact with mercury, and if so, under what conditions and in what way? A. Iron and steel do not amalgamate with mercury and are not affected by contact with it. Copper is slowly amalgamated by mercury and after a short time would be reduced to a paste by contact with mercury if the mercury were in quantity sufficient to do this.

(9289) J. and M. W. ask: Do you know of any means whereby we can obviate the difficulty which we have of late, or since cold weather set in, experienced through the paper being surcharged with electricity in running off the edition of our paper on a perfecting press? It has been represented to us that to place a coating of paraffine on the iron rollers over which the paper passes would afford relief. Do you know as to the probable virtue of such an expedient? Or can you suggest any other way in which we may remedy the evil? A. We think you will find more relief from electricity in your printing paper by use of moisture than by paraffine, which is an insulator and would not conduct the electricity off as you wish. Spraying the rolls is the method in many offices. Steam in the air of the room might produce relief. Trouble from this source is common and we have never known any complete preventive.

(9290) J. A. M. asks: What is the meaning of the occurrence of the sparks of the ocean water when in contact with hand at night? By what means so much ocean water is salted and what parts is the salt formed of? A certain article says radium turns into helium; is helium electricity? A. The light seen in the ocean, when the water is stirred, at certain times of the year is due to the presence of numerous tiny, microscopic animals which are then present in the water in enormous numbers. They are like jelly fish, and shine as the firefly shines on the land. The name "phosphorescence" is given to it. Saltness of the ocean water is produced by the constant emptying of the rivers of the earth into the ocean, while the only escape of water from the ocean is by evaporation and the evaporated water is fresh. The rivers carry down continually a minute proportion of salt in their water, soaked out of the soils. In the centuries of the earth's previous history this salt has accumulated sufficiently to produce the present saltness of the sea water. Inland lakes without outlets are also salt, such, for example, as the Great Salt Lake in Utah, and the Sea of Azof, while the great lakes north of the United States are fresh, since the water is carried off by the St. Lawrence River, and salt does not accumulate. Helium is not electricity, but a gas which has been known for a good many years.

(9291) C. H. M. asks: 1. How is carborundum made? A. Carborundum is made by heating carbon and silica in an electric furnace till they combine chemically into carbide of silicon. There are numerous details, but the essential step in the process is the chemical combination of the carbon and the silicon. 2. Could you tell me how the capacity of a copper wire of an electric current is calculated by allowing 400 circular mils per ampere? A. A "mil" by which wires are rated is one thousandth of an inch. A circular mil is the square of a mil. Thus a wire whose diameter is 10 mils will contain 100 circular mils, and at 400 circular mils per ampere may carry one-quarter of an ampere. 3. How would I determine the capacity of a copper wire by the number, B. & S. gage? What is meant by circular mils? A. A copper wire table usually gives the diameter of each size of wire in mils and in the next column the number of circular mils. Thus No. 10 B. & S. wire is 101.89 mils in diameter and contains 10,381 circular mils, which is the square of the diameter in mils.

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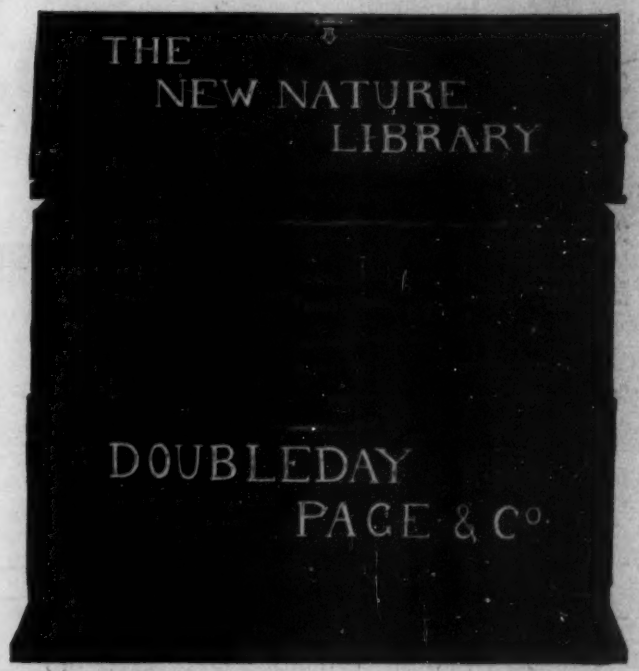

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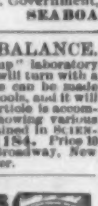

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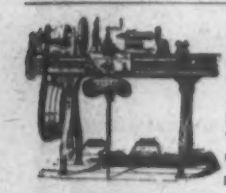

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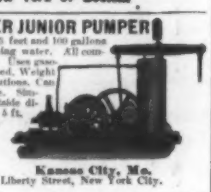

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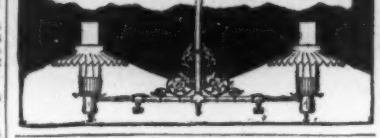

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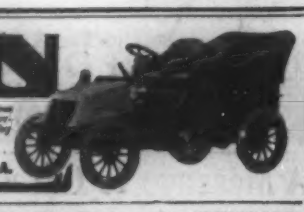

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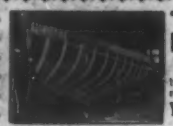

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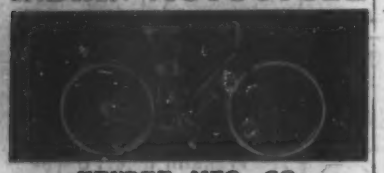

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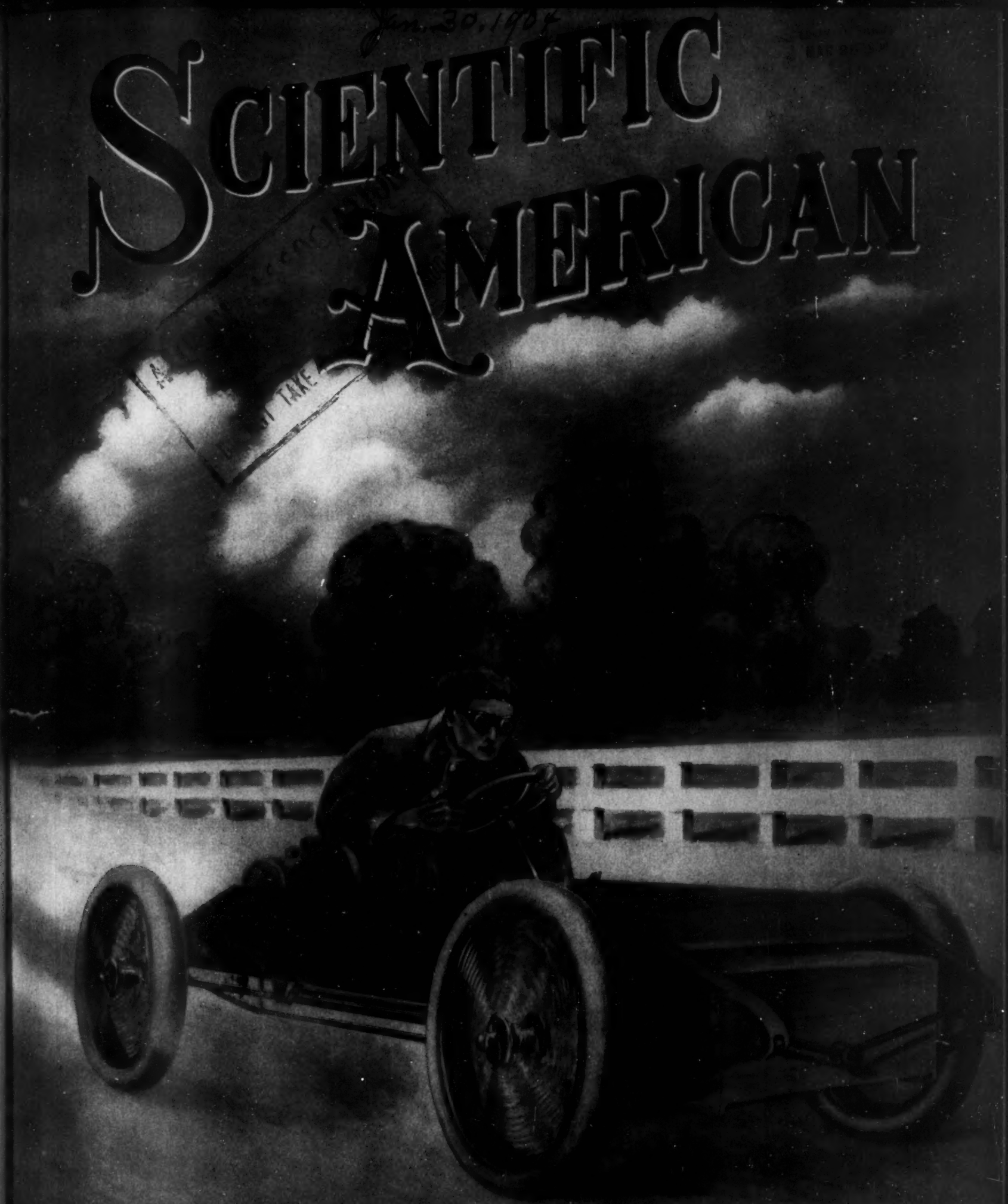

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